Synopsis of Oral and Maxillofacial Surgery

VISIT…

Synopsis of Oral and Maxillofacial Surgery

(An Update Overview)

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JAYPEE BROTHERS
MEDICAL PUBLISHERS (P) LTD
New Delhi

Published by

Jitendar P Vij
Jaypee Brothers Medical Publishers (P) Ltd
EMCA House, 23/23B Ansari Road, Daryaganj, **New Delhi** 110 002, India
Phones: +91-11-23272143, +91-11-23272703, +91-11-23282021, +91-11-23245672
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Synopsis of Oral and Maxillofacial Surgery (An Update Overview)

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First Edition: **2006**

ISBN 81-8061-637-1

Typeset at JPBMP typesetting unit
Printed at Gopsons Papers Ltd., A-14, Sector 60, Noida

Dedicated to

My beloved teachers
Prof Malcolm Harris,
Late Prof Arbinda Dutta
and Prof PV Janardhanan

Foreword

This to me is, indeed, a labor of love. The three chapters, which I am privileged to edit, have been meticulously researched and compiled specifically on impactions, odontogenic and non-odontogenic cysts of the jaws, and diseases of the maxillary antrum.

This is no surprise that the author, who has a penchant for detail, writes this book with all good intention covering maximum of information on the subject.

The *Synopsis of Oral and Maxillofacial Surgery (An Update Overview)* will be eventually-ideal not only for the students but also for the senior practitioners and teachers of this speciality too.

For the students, teachers, and practitioners who like to know the historical and the minutiae of this speciality, this is the book of choice.

This is what our teachers and mentors taught Pradip and I, and, this handbook will surely pass on this message to our future generation of oral and maxillofacial surgeons.

Prof. Kali HC Kapadia

Preface

The *Synopsis of Oral and Maxillofacial Surgery (An Update Overview)*, is not a textbook in true sense but as "compendium" a brief summary of large work, and collective thoughts of eminent authorities, for the students, professionals and teachers.

My special emphasis is given to project the ideas on the subject mainly for undergraduate level, but it can be considered as bridge book in between undergraduate and postgraduate students too. The present subject is changing dynamically day-to-day. Therefore, my intention is limited to focus on the subject as much as possible.

Though I have started write this book very slowly with constant patience with alteration, additions, necessary corrections, omission and improvisation and took lot of time. But I am still not satisfied for ensuing publication of the book.

This book is my humble and honest presentation in lucid and understandable language for our present and future students.

Though the title of the book is an update overview but certain old concepts are still alive and used in recent time, mentioned in this book. Such as, 'Alveolar Purchase' a technique described by Gustav Kruger. 'Stick Tie' by La Quentein Royer recommended a method to control bleeding following injury to the greater palatine artery. The Stobie technique one of the method of extraction and migratory abscess of buccal sulcus, is a common important condition explained by Prof GL Howe.

The present author fortunate enough to attend the British Oral Surgeon's Conference held in London in the year 1990, during his Post PG Training Program in Eastman and University College Hospital, London.

The Scandenavian oral pathologist Professor Vorsmith delivered a lecture on primordial cyst; he discussed the tremendous growth potential of the cyst, explaining the treatment modalities after enucleation and careful curettage recommended the use of Cornoy's solution, as chemocautarization for destruction of any remnants of cystic lining if present. Majority of the participants asked Prof Vorsmith about composition and use of Cornoy's solution, but it was surprisingly to be mentioned our legend authorities like Prof Kurt H Thoma and Prof Harry Archer discussed long before.

Another operation I have to have mentioned where the Norwegian Oral and Maxillofacial Surgeon Mayerhaug described an eminectomy technique in the year 1952, till now, considered as ultramodern method and it was also supported by eminent Prof William Irby and Prof Wanderkwast.

Late Prof Ivor RH Kramer's dictum the management of ameloblastoma in the year 1965, is still alive and also supported by MacIntosh and Marx et al 1991/93.

Recent concepts to TMJDS/MPDS/FAM. The growth and development of odontogenic cyst, osteoclast activating factor (OAF) are quoted and recorded from Hunterian lecture of Prof Malcolm Harris in March 1974 mentioned in this book.

I am indebted a lot to my respected and beloved teachers, Late Prof Arabinda Dutta, Prof PV Janardhanan and especially to legend Prof Malcolm Harris to write this book.

Thought's knowledge, notes, lectures, total concepts, clinical discussion, operative session and perspective of Prof Harris are instilled and saturated in every page of my book, such as ultrasound treatment in ORN. Facial pain lecture, calcitonin therapy in central giant cell lesion, an appraisal of TM Jt ankylosis over 15 years review of management and so many things.

I am grateful to Prof Teruo Ito of Nagasaki University of Japan and Prof Valerian Popescu Institute of Medicine Bucharest, Rumania, for a new technique of repair of oroantral fistula and treatment method of hemangioma. I am also grateful to Prof Heinz Kole of Graz University, Austria and Bruce N Epkar for personal communication in early 80s regarding orthognathic surgery.

In most of the chapters, I intend to put a heading named 'Analytical Observation', which contains comments and concepts of various observer as well as important points for discussion and reappraisal and ready references for the readers.

Lastly, I mention the Snawdon's technique for treatment of large maxillary dental and dentigerous cyst involving maxillary antrum, which was appraised by Margarate and Prof Gordon R Seward in their excellent review article, which contains the observation of Prof Ficking. I convey my deepest respect to Prof Kali HC Kapadia having, an extra-large sympathetic heart and loveable teacher who gave valuable time for correction, addition, alteration, and suggestion for few chapters and forward of my book.

I know my maiden sincere efforts having many mistakes, omission etc need more correction, alteration and addition. I personally feel elated and welcome the constructive criticism from all corners of the learned readers.

Lastly, I convey my best wishes and love to Dr Kamala P Singh, Chairman and DG, Sarjug Dental College, Darbhanga and specially to all my students and colleagues past, present and future.

(Pradip K Ghosh)

Acknowledgements and Remembrance

Firstly, my humble submission and pray to *Almighty Suprimo (Adyama).* Without her blessing, it is not possible for my dream ultimately to come into shape.

I personally submit my humble deep gratitude and acknowledge the legendary authorities, which enriched my thoughts, knowledge indirectly and directly during my movements in academic field. Some of them are deceased; man is mortal but their extensive work is still alive and countable beyond the ages.

I like to mention the following legendary authorities, which include Prof Kurt H Thoma, Prof Harry Archer, Prof Gustav Kruger, Prof William Irby, Prof Charles A Waldron, Prof Shafer, Sir William K Fry, Sir Terrence G Ward, Prof JR Moore, Prof Toller, Prof Poswillo, Prof Lucas, Prof D Laskin, Prof Paul Bramley, Prof Heinz Kole, Prof Ivor RH Kramer, Prof Homer C Killy, Prof Norman Rowe, Prof GL Howe, Prof John William, Bruce N Epkar Peter Bank, Prof Jens J Pindborg, Prof Gordon and Margarrette Seward obviously Prof Malcolm Harris and so many.

I convey my best wishes and regards to my ex-teachers mainly Prof Arup K Das, Late Prof Arabinda Dutta, Prof PV Janardhanan, Late Dr Sankarananda Talukdar, Dr SN Sikdar.

I am indebted a lot and regard to my mentors late Pabitra Kumar Ghosh the then Private Secretary to CM West Bengal and Prof Ramendranath Kundu; without their help, it is not possible for me to reach this level presently. I also convey my sincere thanks and love to my well-wisher family friend Sri Sumantra Chowdhury, MSc, IAS for constant encouragement in my life.

I still remember ever-smiling Dr K Kamal, Dr Uma Maheswari and Jovial Dr Mahalingam, Dr Manivannan the then academic staff members of the Department and still remember the tough administrator but soft-spoken to me Prof BP Rajan (The then principal, Madras Dental College). I still remember the Senior Prof B Srinivasan of Annamalai University. I am grateful to Prof D Basak, MS Mch for writing the chapter of Cleft Palate and Cleft Lip. I am also grateful to Prof S Srivastava, MD Pharmacology, Ex-principal, DMC for his kind co-operation. I also convey my thanks to Sri Promod K Singh and Sri Lalan Singh, Directors, Sarjug Dental College and my family friend and well-wisher Sri Biplob Chakraborty for his moral support.

I convey my best wishes and love to my family for their constant encouragement for writing this book. I also convey my sincere thanks to my batchmate Prof TK Saha, Ex. Principal R Ahmed Dental College and past PG students specially Dr Debdutta Das MDS, Dr Nupur Chakraborty MDS, Dr Amit Roy Jr MDS, Dr Monimoy Banerjee, MDS and Dr BK Biswas, MDS, Dr Sunil Thapar for their intense involvement in writing this book.

I also convey thanks to Sri Jayanta Chatterjee, my DTP typist for his efforts to publish my book.

I also thank Shri JP Vij, Chairman and Managing Director, Mr Tarun Duneja, GM (Publishing), Mr PS Ghuman, Senior Production Manager, Ms Mubeen Bano, Mr Bharat Bhushan and Mr Sanjoy Chakraborty, RSM (Kolkata) of Jaypee Brothers Medical Publishers for their entire support.

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ONE

Sterilization and Disinfection

• Sterilization and Disinfection — Role • Sterilization or Disinfection of Dental Equipment

Sterilization and Disinfection Play Very Important Role of Any Surgical Modality

Sterilization means complete killing or removal of all living forms including endospores from an object or a location. It is an absolute term, i.e. an object is either sterile or not sterile.

Disinfection means destruction of pathogenic microorganisms only and does not necessarily include endospores or viruses.

Antiseptics means chemical disinfection of the skin, mucous membranes, or other living tissues. The agents with which this state is achieved are called antimicrobial agents.

Asepsis is the avoidance of pathogenic microorganisms. In practice, 'aseptic technique' is one, which aims to exclude all microorganisms. Surgical technique is aseptic in the use of sterile instruments, clothing and the 'no touch' technique.

Antisepsis is the procedure or application of an antiseptic solution, or an agent, which inhibits the growth of microorganisms. Examples are, scrubbing and preparation of operative site.

1. *Pattern of microbial death:* A population of microorganism treated with antimicrobial agent does not die all at once; instead, they die at a constant rate. The total time required is dependent upon the initial microbial concentration (as well as the temperature and/or concentration of the chemical agent). Endospores are the most resistant forms of life.
2. Sterilization frees an object of all forms of life. It can be achieved by using heat, radiation, filtration and chemicals.
3. The heat used in sterilization is either moist heat such as in an autoclave or dry heat in a hot air oven.

Autoclaves are mechanized versions of home pressure cookers. Water is boiled and the air inside the vessel is expelled by the steam. The vessel is then sealed; and, the pressure is allowed to build up. The rise of pressure causes the temperature of steam to exceed that of boiling water. Safety release valves prevent excess pressure from building up. Autoclaves are usually operated at 15 psi at 121°C for 15 minutes or at 20 psi at 134°C for 3 minutes. Boiling is not a method of sterilization because a temperature of 100°C is not high enough to kill all organisms. Autoclaves are available in many sizes, with various automatic features. Autoclaves are the best and most dependable method of sterilization and used for surgical packs, rubber materials, metallic instruments, glasswares, culture media, and any heat-resistant contaminated material. Moist heat cannot be used for sterilization of substances in sealed containers or hydrophobic substances like oils and waxes. The major drawback of moist heat is rusting of non-stainless steel instruments. Hot air ovens are usually operated at 160 to 170°C for 1 to 2 hours. Dry heat requires higher temperatures and longer times than to do usual steam sterilization, because proteins are denatured less-readily when dehydrated. Hot air ovens are used to sterilize glassware, metallic instruments, and hydrophobic substances. Microwave is not a reliable method of sterilization.

4. *Radiation:* Ionizing radiation such as X-rays and gamma-rays inactivate microorganisms by reacting with their DNA. Radiation is used to sterilize pharmaceutical and disposable medical supplies.
5. *Filtration* is used to sterilize heat-sensitive material in solution and gases. Membrane filters with

Theme author of this chapter—Late Prof Biprodas Sanyal. Edited and modified by Dr Pradip K Ghosh.

varying pore sizes have replaced the earlier filters such as Seitz (asbestos) and Chamberland (ceramic).

6. *Ethylene oxide* is an example of a chemical sterilizing agent; it is used to sterilize heat-sensitive materials such as plastic catheters, prosthetic devices and disposable medical supplies.
7. The effectiveness of a sterilizing technique is assessed by its ability to kill the most resistant life-forms such as bacterial spores (e.g., *Bacillus stearrothermophilus* spores). Records of temperature, pressure and time are regularly made. *Autoclave tape such as Bowie-Dick is routinely used to ensure that the autoclave is functioning properly.*
8. *Disinfection* is defined as removal or killing of infectious microorganisms. Disinfectants are antimicrobial agent applied to inanimate objects for disinfection. Antiseptics are chemical disinfectants used on living tissues. Disinfection is achieved by physical or chemical agents.
9. *Moist heat* is the best method of disinfection. Boiling for 5 to 10 minutes kills most pathogens. *Pasteurization* involves heating to 60 to 80ºC for 30 minutes to 30 seconds; it kills most vegetative forms of bacteria but not spores.
10. *Ultraviolet light* is a form of non-ionizing radiation that is lethal to microorganism. However, it has very little penetrability, and therefore used on flat surfaces and air.
11. There are many *chemical disinfectants* and *antiseptics*. Before we can use them properly, it is important to know about them. In general their activity is affected by the following factors:
    1. Concentration of the chemical.
    2. Length of exposure time.
    3. Temperature and pH.
    4. Number, nature and types of microorganisms.
    5. Amount of organic material present.
12. *Alcohols:* Ethyl alcohol, isopropyl alcohol and methylated spirits are bactericidal but not sporicidal. They act by denaturing protein. Because proteins are not hot denatured in the absence of water, a 70 percent solution of alcohol in water better than absolute alcohol. Alcohols are often used with other disinfectants such as chlorhexidine and povidone iodine.
13. *Aldehydes:* Formaldehyde and glutaraldehyde act by denaturing protein and nucleic acids. Formaldehyde is used as a 37 percent solution in water (called formalin). Glutaraldehyde is effective against bacteria, viruses and fungi. It is used to sterilize instruments such as endoscopes that cannot be autoclaved. Both are skin and eye irritant.
14. *Chlorhexidine* is a bisguanide that affects bacterial cell membrane permeability, leading to leakage of intracellular materials. It is less effective against gram-negatives. It is used in combination with alcohol or detergent for antiseptic use, and is a good antiplaqe agent when used as mouthwash. It has low toxicity. Long-term oral use causes tooth staining.
15. *Halogens* used as disinfectants and antiseptics include chlorine and iodine.

Sterilization or disinfection of dental equipment

Equipment	*Suggested treatment*
Dental hand piece	Autoclave, ethylene oxide
Hand instruments	Hot air oven, autoclave
Mirrors	Hot air oven, autoclave
Forceps, elevators, scalpel handles, retractors and other surgical items	Autoclave
Endodontic instruments	Hot air oven, autoclave
Gauzes, cotton wool and paper points	Autoclave after wrapping
Linen	Autoclave after wrapping
Surgery floors	Wash daily with detergent and dry
General working surfaces	Wash daily with detergent and dry
Bracket table	Wipe with chlorhexidine in alcohol or 70 percent isopropyl alcohol between patients
Bullk disposable syringe, gloves, mask and dressing	Gamma radiation
Purification of air in the operating room	Ultraviolet rays

16. *Hypochlorites* act by releasing chlorine that is an oxidizing agent killing most bacteria and viruses including hepatitis B virus. It is a very effective disinfectant in hospitals and home. The main disadvantages are corrosion of metals and inactivation in the presence of organic matter.
17. *Iodine,* like chlorine, it is a strong oxidizing agent and an effective antiseptic. Its drawbacks are staining, hypersensitivity and corrosion. Iodine is used either as tincture of iodine (i.e., iodine in alcohol) or as povidone iodine (i.e., iodine complex with polyvinyl-pyrrolidone).
18. *Phenols* are very toxic and so only the less toxic derivatives are used. They act by damaging the cell membrane and denaturing proteins. Some well-known phenol derivatives are: Dettol (chloroxyphenols), hexachlorophene (bis-phenol), and cresol (methyl phenol).
19. *Detergents* or surface-active agents act by damaging microbial cell membrances. They are generally used as cleaning agents. Benzalkonium chloride (a quaternary ammonium compound) is used as a skin antiseptic.
20. *Hydrogen peroxide* is a strong oxidizing agent and used as an antiseptic to clean wounds.
21. Tests for effectiveness of disinfectants and antiseptics. The in-use test is one of many widely-used tests. In this test, sample of the diluted disinfectant in use is examined for viable bacteria.
22. The choice of antimicrobial agent to be used depends on many factors:
    1. Nature of the item and its intended use.
    2. The kind of microbe to be treated.
    3. The risk of cross-infection.

Two

Healing of Extracted Socket and Healing of Bone Following Fracture/Surgery

• Various Modalities of Healing • Healing of Bone • Factors Influencing Healing

The healing of soft tissue and bone are natural physiological phenomenon, provided conditions are favourable for revival of tissue damage (healing).

This automatic process having different phases. The surgical induce trauma, e.g. extracation, oral surgery or even fracture needs healing. The knowledge about healing is necessary before entering into the other topics.

Theme of healing is summarized below:

Surgery induce tissue trauma → Hematoma → Organization of hematoma → Fibrin (clot) → Organization of clot and formation of healthy granulation tissue → Fibrous tissue → Callus formation → Organization of callus in different stages → Calcification of bone (osteoid tissue) → Remodeling of bone.

Various Modalities of Healing

Healing of Primary and Secondary Intention

Phases of wound healing consist of phases like:

Inflammation: Starts from 0–4 days after injury. This phase produces the vascular and cellular changes. Vascular consequences are, initial vasoconstriction and subsequent vasodilatation, and fibrin and plasma leakage within the tissue. Cellular consequences are polymorph releases the lysosomal enzymes. Activity of macrophages increased and later, the process of phagocytosis propagated on addition to lymphocytic infiltration.

Proliferative phase: Days 3–3 weeks after injury. Activity of fibroblast is increased and produces ground substance and collagen precursors along with new capillary buds, fibroblasts form the granulation tissue.

Remodeling phase: Three weeks after injury. Collagen is usually laid down in abundant fashion and after that the arranged orientation of this collagen is more or less form normal pattern without replacing elastin.

Primary intention of healing means close approximation of wound edges, which produce small hematoma, subsequently the granulation tissue; reorganization is therefore minimal and healing results.

Secondary intention of healing means separation of wound edges, which produces large hematoma and needs volume of organization more with increased activity of fibroblast, capillary network in the greater surface areas over which new epithelium must spread.

First Week

Extraction socket healing an example of secondary intention: The features of inflammatory reaction consists of rubor (redness), tumor, (swelling), color (heat), dolar (pain), and loss of function. Hematoma within socket formation of clot followed by proliferative phase that is activation and formation of in growth fibroblasts and capillaries. Epithelium migration to cover the underlying granulation tissue followed by resorption of bone from socket margins.

Second Week

Activation of osteoid tissue and formation callous. Epithelialization process about to complete.

Third to Six Week

Callous is replaced by bone, remodeling of the bone. Resorption of lamina dura completed.

Healing of Bone

Healing by primary intention, less than one mm gap/preposition between bone ends and rigid fixation. This produces minimum callus.

Healing by secondary intention where the greater gap of bone ends, osteoblasts (from periosteum and endosteum and blood) produces larger organising callus and extending between and beyond the end of the fracture. This is emphasized even more if fixation is not rigid.

According to Kruger healing of bone is divided into three overlapping phases:

1. Hemorrhage followed by organisation clot and proliferation of blood vessels, this is considered as a non-specific phase occur during 0 – 10 days.
2. Callus formation—A rough woven bone or primary callus looks overlap is formed in the next 10 – 20 days. A secondary callus, which form Haversian systems during period of 3 week to 2 months.
3. Functional reconstruction—It takes 2 to 3 years.

Weinmann and Sicher divided the healing of fracture into six stages:

1. *Hematoma (Clotting of blood)*—Surrounds the fracture end and extends to bone marrow to the soft tissues. It coagulates 6 to 8 hours after the injury.
2. *Organization of hematoma:* A meshwork of fibrin fragments of periosteum, mussel fascia, bone and bone marrow. Most of the fragments are digested and removed by the inflammatory cells. Which are requisite criteria of hemorrhagic phase of bone healing. Capillaries and fibroblast invade the clot in the same time, i.e. 24 to 48 hours. The proliferation of blood vessels is a characteristic feature of early organising hematoma.
   Resorption of bone is a characteristic in late hematoma. The movements of blood running via the area of active hyperemia and not disuse atrophy responsible for resorption of bone.
3. *Formation of fibrous callus:* The organized hematoma is replaced by granulation tissue.
4. *Formation of primary bony callus:* 10 to 30 days after injury or fracture. This primary callus is again divided into different categories, depending on location and function.
   a. *Anchoring callus*—Develops on outer surface of the bone near the periosteum.
   b. *Sealing callus*—Develops on inner surface of the bone and sheals the marrow space and form endosteal proliferation.
   c. *Bridging callus*—It forms on the outside surface between the anchoring callus on end of fracture lines. This callus is primarily cartilaginous.
   d. *Uniting callus*—Forms between the ends of bones.
5. *Formation of secondary bone callus:* This is actually matured bone, which replaces the immature bone of the primary callus (20 – 60 days).
6. *Functional reconstruction of fractured bone:* It requires over months or year to fulfill the process with alternate activity of osteoclast as well as osteoblast cells.

Factors Influencing Healing

Tissue factors—blood supply reduced in smoking and diabetes. Drainage (venules and lymphatic are poor post-radiation therapy). Nutrition (low protein level in debilitated patient)

Pre-existing Infection

General immune response reduce (elderly concurrent disease, steroids immunosuppression). Local immune response reduced (radiotherapy, topical steroids).

Physical Factors

Barriers cuts, tissue planes open, reduced salivary flow. Microbes from patient to other patient via instruments/working surfaces, microbes from operator.

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THREE

Exodontics or Exodontia

• Indication of Extraction of Teeth • Contraindication of Extraction of Teeth • Extraction Technique • Method of Extraction • Principles of Extraction • Closed Method • Indication for Open Method • Principal Modalities of Transalveolar Extraction • Principles of Elevator in Exodontia • Order of Extraction • Principles of Primary Tooth Extraction • Complications of Tooth Extraction

Oral and maxillofacial surgery is a branch of dentistry, which deals with clinical and radiological diagnosis, medical and surgical management of disease, injuries, correction of defects of jaws and orofacial structures including soft and hard tissues.

Exodontia or exodontics, the technique of methodical modalities of tooth extraction is known as Exodontia. *Exodontia or extraction of tooth* is defined as, painless removal of tooth or root with minimal injury to the surrounding soft tissue and bone. Extraction of teeth is one of the minor oral surgical procedures.

Indication of Extraction of Teeth

1. Periodontal disease, when periodontal treatment fails to recover the disease.
2. Dental caries and its consequences, when the conservative treatment fails after or even RCT/Apicoectomy.
3. Erosion, abrasion and attrition.
4. Trauma and injuries of teeth and dislocation of tooth from its socket.
5. Impaction.
6. Therapeutic extraction, which includes extraction of upper and lower 1st and 2nd premolars.
7. Extraction due to orthodontic reasons, extraction of supernumerary, serial extraction and Wilkinson's theory.

Contraindication of Extraction of Teeth

Local Factors

1. Acute pericoronitis in relation to 3rd molar infection with facial cellulitis, acute gingivitis and stomatitis, acute maxillary sinusitis in relation to upper molar and premolars.
2. Extraction in case of irradiated jaw may leads to osteoradionecrosis.
3. Tooth within the malignant growth.
4. Central hemangioma, arteriovenous shunt, aneurysmal bone cyst.

Systemic Factors

1. *Bleeding disorders like hemophilias, leukemias and purpuras* in case of extraction. Haematologist's consultation is mandatory to avoid complications.
2. *Cardiac problems:* Hypertension, congestive cardiac failure, ischemic heart disease, septal and valvular defects. Consultation of physician is necessary before the surgery. The oral flora contain *Streptococcus viridans* which is active during minor oral surgical procedure that may cause subacute bacterial endocarditis in the rheumatic valvular defects. This can be controlled by suitable antibiotic coverage before surgery.
3. *Uncontrolled diabetes mellitus:* Leads to risk of infection and delayed healing. In case of controlled blood sugar or patient under the antidiabetic treatment, extraction or minor surgery can be done under the prophylactic antibiotic coverage.
4. *Pregnancy:* The first and last trimester is contraindicated for extraction, risk of premature delivery and the chance of *supine hypotensive syndrome.* Only the middle trimester is safe for extraction.
5. *The patient under anticoagulant therapy:* Extraction can be done under precaution with consultation of physician.

Table 3.1: Extraction technique

Mandibular Teeth	
Incisors: Slim ovoid root *Canines:* Long ovoid root	Slow labial and lingual expansion, little rotation at the end.
1st and 2nd premolars: Single ovoid root	Rotation in horizontal direction, slight movements to start with
1st and 2nd molars: Two roots, mesial and distal, may be divergent.	Lingual and buccal expansion – 'figure of 8' movement when tooth moving may take time
3rd molars: Two roots, variable	
Maxillary Teeth	
Incisors: Single cone-shaped *Canine:* Very long root	Mostly rotation Requires very slow buccal expansion to avoid fracture in buccal plate some rotation
Premolars	
1st premolars – Two fine roots easily fractured *2nd premolars* – Single oval root	Again more buccal than palatal expansion with less force; great care with I premolar
1st and 2nd molars: Three roots- masiobuccal, distobuccal and palatal Divergent in the 1st molar	Forceps beak placed both buccal roots and the palatal, the main movement is buccal. Once the main buccal expansion has been achieved other movement can be employed gently
3rd molars: Three roots, frequently confluent and fused together	Consider elevator if access poor.

6. *Patient with liver disorders like hepatitis or cirrhosis with jaundice having the bleeding problems:* Proper clearance from the physician is necessary prior to extraction, examination of blood biochemistry and liver function test.

Extraction Technique

All the suggested modalities apical thrust with the forceps or push directed towards apically is mandatory (Table 3.1).

Method of Extraction

1. *Closed or intra-alveolar.*
2. *Open or transalveolar extraction:* Some prefers to consider the open method or TAE consider as surgical method but all extraction methods consider oral minor surgical procedure.
3. *Stobie technique:* It is one of the method of extraction for multiple lower incisors engaging a straight elevator inserted in between tooth and rotated for luxating teeth within the socket and gradually remove by forceps easily.

Principles of Extraction

1. *Position of the patient*
   a. In case of lower teeth, mandible should be parallel to the floor.
   b. In case of upper teeth the mandible should be 45-degree angle to the floor.
2. *Position of the chair:* In case of upper tooth position of the chair should be 3 inches below the shoulder level of the operator, in case of lower teeth the chair height should be adjusted 6 inches below of the operator's elbow. If the operator standing behind the patient the chair should be sufficiently lower to enable the operator to have maximum mechanical and visual access.
3. *Position of the operator:* All teeth except lower teeth, cheek teeth, front and right side of the patient, in case of right-handed operator, in case of left-handed operator the above position in reserve. In case of right mandibular cheek teeth, behind the patient. In case of all upper teeth, the front and right side of patient in case of right-handed operator. In case of left-handed operator, the case is reverse.
4. *Position of the left arm* in case of right-handed operator. Left thumb should support the mandible and index finger retract the cheek tissues and middle finger control the hyperactive tongue for maximum visual and mechanical access of the operator. In case of lower teeth left side. In case of right lower teeth the index finger retract the cheek tissues and thumb will act to control the tongue and remaining fingers support the mandible to

avoid the injury to T.M. Jt. In case of left upper teeth thumb will support the palatal alveolar bone and index finger retract the buccal cheek tissues. In case of right upper teeth the thumb will retract the buccal cheek and index finger support the palatal alveolar bone. In case of left-handed operator, the function of right hand will be reverse as mention above.

Closed Method: Principles of Extraction

1. Forcep blade should be placed below the C. E. junction on the sound root mass, apical thrust should be first.
2. Use of mechanical principals which includes:
   a. Expansion of the bony socket to achieve the dislodge and removal of concerned tooth or root.
   b. The use of lever and fulcrum–using force to elevate the tooth or root.
   c. The use of wedge or wedges within the root and its bony socket.
3. Traction towards least resistance.
4. Alveolar purchase: Kruger recommended a unique closed method technique.

For removal of mostly anterior teeth or root. A fractured tooth often can be grasped by root forceps or anterior forceps. Alveolar purchase may obtained by detaching the labial gingival cuff with a small, sharp curet. Then labial beak of forceps is then placed under the tissue on the labial plate of alveolar bone. Pressure on a sharp forceps will grasped the root along with labial alveolar bone. The root with the cut alveolar bone delivered easily. This method is very much successful.

Indication for Open Method or Transalveolar Extraction

1. Failure to remove a tooth or root by open method
2. Unfavourable root pattern
3. An abnormal number and shape of roots
4. Fracture or caries extending into the root mask
5. Hypercementosis and ankylosis of tooth or root
6. Bony sclerosis and pathological lesions
7. Impacted teeth.

Principal Modalities of Transalveolar Extraction Steps and Caution with Criteria (Fig. 3.1)

1. Incision—considering the anatomical underlining structures carefully making an incision for TAE.
   a. In case of mandibular first and second premolar careful about the position of mental nerve.
   b. In case of mandibular second and third molar careful about facial artery (both 1 and 2 placed bucally).
   c. In case of mandibular 3 molar lingual nerve place lingually.
   d. In case of maxillary 2 and 3 molar pterygoid venous plexus placed buccaly.
   e. The base of the incision should be broader than its tip to provide an adequate blood supply.
   f. Reliving incision should not be made at acute angle.
   g. The design of incision should be sufficient to achieve to maximum visual and mechanical access for the surgery.
   h. The flap margin should rest on sound bone, post-operatively.
2. Raising the mucoperiosteal flap.
3. Removal of bone in around retained root or tooth by bur or chisel.
4. Establishment of point of application for elevator.
5. Removal of tooth or root from socket.
6. Trimming of the bone by bur or bonefile.
7. Toileting of the wound.
8. Control of bleeding.
9. Reposition of the mucoperiosteal flap and wound repaired by suture.
10. Pack.
11. Prescription, which includes advises, instructions and medicine.

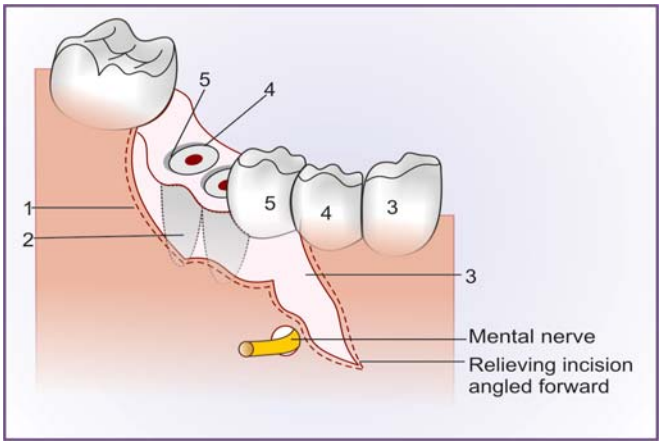

Fig. 3.1: Steps of surgical removal of the right first mandibular molar
1. Raising the buccal mucoperiosteal flap, 2. Retained root mandibular first molar, 3. Lateral plate of mandibular alveolus, 4. Initial area of bone removal in a "trench" around retained root, 5. Establishment of a 'point of application' for elevator.

The Principles of Elevator in Exodontia

1. Class I and II levers
2. Wedge
3. Pulley
4. Wheel and axle.

The elevator should always be placed between the tooth and alveolar bone and alveolar bone should be used as fulcrum. Adjacent teeth and lingual cortical plate should never be used as fulcrum.

To obtain maximum mechanical advantage the fulcrum should be near the point of resistance and effort arm should be longer than resistance arm (principal of class I levers).

Order of Extraction (Prof J Moore)

To prevent bleeding from the socket of a extracted teeth obscuring the field of operation it is better to remove the lower teeth before uppers, and posteriors before anteriors. It is wise to begin with the most painful and problem tooth.

According to Prof Harry Archer, Maxillary teeth should be extracted first because:

1. Early action of LA in maxilla is there.
2. The debris etc. does not fall once maxillary molars have been placed thus allowing clean field for mandible.

The Principles of Primary Tooth Extraction

Almost same as permanent.

Gentle care should be taken during extraction:

1. Judicious use of elevator.
2. During extraction of primary teeth the beak of the forceps must be carefully placed. So that it should not injured the hidden permanent tooth bud.
3. Identification of primary is very important.

Complications of Tooth Extraction (Summarized From Prof Geoffray L Howe)

Failure to:
- Achieve anesthesia
- Remove the tooth with either forceps or elevators

Broken or fracture of:
- Crown of tooth being extracted
- Roots of tooth being extracted
- Alveolar bone
- Maxillary tuberosity
- Adjacent or opposing tooth
- Mandible

Dislocation of:
- Adjacent tooth
- Temporomandibular joint

Displacement of a root:
- Into the soft tissues
- Into the maxillary antrum
- Under general anesthesia in the dental chair

Excessive hemorrhage:
- During tooth removal
- On completion of the extraction
- Postoperatively

Injury to:
- Gums
- Lips
- Inferior dental nerve or its branches
- Lingual nerve
- Tongue and floor of mouth
- Greater palatine artery

Postoperative pain due to:
- Damage to hard and soft tissues
- 'Dry socket'
- Acute osteomyelitis of the mandible
- Traumatic arthritis of the temporomandibular joint

Postoperative swelling due to:
- Edema
- Hematoma formation
- Infection
- Trismus
- The creation of an oro-antral communication
- Syncope
- Respiratory arrest
- Cardiac arrest
- Anesthetic emergencies

Complication of tooth extraction which summarized above of which the following important and common complication will be discuss below:

1. Syncope
2. Pain, which includes dry socket (ASD)
3. Postoperative swelling
4. Bleeding (paroperative and postoperative)
5. Trismus

Remaining complication will be discussed in subsequent chapter.

Syncope

Transient loss of consciousness due to cerebral ischemia.

Probable Causes

a. Apprehension and fear during sitting in the dental chair for injection of LA solution and for extraction procedure.
b. Failure to achieve confidence of the patient.
c. Rapid pushing of injection of LA solution or accidental injection of solution to the vessels.

Prevention

a. Reassurance.
b. To achieve confidence of the patient with soft conversation.
c. Anxiolytic medicine prior to surgery. Diazepam (5 mg) day before surgery night and one dose half an hour before surgery.
d. Patient should not come with empty stomach.

Clinical Features

a. Pallor (skin and mucous membrane).
b. Abnormal sweating and respiration.
c. Cold calmy skin, fall of blood pressure, reduce pulse rate.
d. Feeling of nausea, tongue and lip become pale (very important sign).

Treatment

a. Change the patient position. Sitting to supine. Head should be lower than feet (15° Trendelenburg position).
b. Flashing the face with cold water.
c. Therapeutic oxygen inhalation.
d. Sp. Ammon Aromaticus (stimulant haustus).
e. Glucose drinks.
f. Injection dexamethasone if necessary.
g. Injection mephetemine sulphate is given in case of fall of BP.
h. If the pulse is extremely weak, injection atropine sulphate is given slow IV 0.6 mg diluted in 5 ml distilled water till the pulse become palpable.

If extraction was completed, carefully, observe the patient at least two hours, before leaving the patient. Check the pulse and BP. If extraction is not completed patient may be release after recovery. And inform the patient to come the next convenient dates. Sympathetic behaviour is essential for treating the above problems.

Supine Hypotensive Syndrome

The indication of extraction in pregnancy only the third trimester, the position of the patient during the treatment is very important. If the patient is in semi-reclined or full supine position, fetus will compress the inferior vena cava, thereby interfering the venous return. This may be result in supine hypotensive syndrome.

By turning the patient to the left side either in the sitting or in the relying posture, pressure on the vessels can be avoided.

Pain, Which Includes Dry Socket (ASD)

Post-extraction pain is mainly due to surgical induced trauma. Any suitable anti-inflammatory analgesic is suitable for eradication of above problem.

Dry Socket (Alveolitis-Sicca-Dolorasa)

Dry socket the term coined by Crawford (1896), characterized by local complication of tooth extraction. Many other descriptive terms used in time to time, starting from:

- Necrotic alveolar socket by Alling (1959).
- Alveoalgia by Bjercke (1960).
- Alveolar osteitis by Shafer (1974).
- Localized osteomyelitis by Israel (1976).

The Probable Causes

a. Undue trauma during extraction.
b. Pre-existing infection.
c. Disturbances of the clot may be due to vigorous mouth wash or violent curettage.
d. Increase fibronolytic activity.
e. Localized impaired vascular supply.
f. Smoking and use of oral contraceptive increases the incidence.

Clinical Features

a. Continuous throbbing and excruciating pain may refer to other areas.
b. History of extraction 48 to 72 hours before.
c. The alveolar socket covered with grayish necrotic tissues.
d. Denuded alveolar bone with halitosis.

Treatment

a. Obtained LA.
b. Irrigation with warm saline or antiseptic sol. like chlorhexidin for removal of dead bone if any or infected tissues.
c. Curettage is contraindicated.
d. Obtundant soothing dressing, i.e. ZOE mixed with cotton to cover denuded bone or whitehead varnish packs are also used.
e. A suitable paste composed of water-soluble waxes: Polyethylene glycol incorporating with lignocaine hydrochloride and domiphan bromide and distilled water. The material slightly softens with warm and inserted painlessly into the socket.
f. Whitehead varnish (composition of WHV Benzoin 10 parts prepared Storax 7.5 parts, Balsum of Tolu 5 parts, Iodoform 10 parts, solvent Ether 100 ml) soaked with cotton gauge. After drying the gauge this can be used as pack or dressing.
g. A course of suitable antibiotics, analgesic, and reassurance to the patient.
h. Follow up with frequent visit.

Postoperative Swelling

This may due to haematoma, that means the collection of blood during surgical maneuver in the tissue planes which was not controlled prior to closing the surgical wound.

Management

a. Control bleeding prior to closure the wound.
b. Application of ice extraorally, consumption of chilled water.
c. To avoid infection a suitable antibiotics.
d. Chymoral (Chymotrypsin enzymes) may be prescribed to reduce the swelling and non-steroidal antiflammatory like ibuprofen with paracetamol or injection diclofenac Na IM daily for 3 days.

Postoperative Edema

a. This is due to surgical handling of the tissue and liberation of certain enzyme like substance histamine and heparin.
b. Management includes careful handling of the tissue.
c. Frequent saline mouth wash after 24 hours.
d. To avoid infection a suitable antibiotic.
e. Chymoral (Chymotrypsin enzymes) may be prescribed to reduce the swelling.

Emphysema

a. This is due to the air entrapment in the tissue planes, use of air instruments during cutting the bone. This can be avoided non-inclusion of air instruments.
b. The features may be detected by tender palpation of crackling sound.

Bleeding (Paroperative, Reactive and Postoperative)

- During extraction
- Reactive bleeding after 24 hrs
- Post-extraction after 48 to 72 hrs

During Extraction or Paroperative Bleeding

Careful about tender handling of the soft tissue and alveolar bone. It will definitely help to control paroperative extraction bleeding. Undue trauma causes damaging the nutrient vessels of the bone.

The reactive bleeding: It is mostly due to the rise of blood pressure in some patient because of apprehension and fear of post-extraction bleeding. The semi-supine position preferably sitting posture helps to reduce the bleeding and maximum visual and mechanical access can be achieves to control the above problem.

Treatment includes reassurance. Diazepam 5 mg at bed time/if necessary antihypertensive treatment with consultation of physician or cardiologist.

Postextraction Bleeding after 48 to 72 hours

The postextraction bleeding is mostly due to infection. The toxin liberated by the local bacteria digested the clot.

Management of Bleeding may be Summarized as:

3P and 3S

3P

- Pressure
- Pack
- Posture

3S

- Saline
- Styptic
- Suture

a. Treatment modalities may be a combination of both or according to the case
b. Bleeding from the capillary bed presented by oozing of blood
c. Controlled-method application of local haemostatic (styptic) like adenochorome monosemicarbazone (locally and systematic methods)
d. EACA (Epsilon aminocaproic acid) (local and systematic)
e. Ethampsylate (local and systematic)
f. Oxidized cellulose (Oxycel, local)
g. Human thrombin powder (local)

Surgical (Oxidized Cellulose)

a. It is glucose polimer based, sterile knitted fabric by the control oxidation of regenerated cellulose (local hemostatic).
b. Fibrin glue (local hemostatic). It is a biological adhesive, composed of thrombin, fibrinogen and factor XIII and aprotinin.
c. Thrombin converts fibrinogen to unstable fibrin clot, factor XIII stabilize the clot and aprotinin prevents its degradation.
d. Hemolock (Feracrylum HCl)
e. Pressure and pack with soaked and dried with white-head varnish gauge.
f. Suture if necessary.
g. Bleeding from the arterial wall mostly due to trauma or injury. The spurting of blood, frank red in colour.

Management

a. Catch hold the artery and ligation.
b. Surgical diathermy.

Or

c. Electrocoagulation/Argon beam coagulator (a superior form of electrocoagulation method using Argon gas).

Bleeding from the Bony Bed

a. Crush the nutrient vessels supply the bone by blunt instruments or artery forceps.
b. Application of Horsley's bone wax (Bees wax 7 parts, olive oil 2 parts, phenol 1 part).
c. After control suture with pressure pack.
d. Postextraction bleeding usually the disturbances of clot and due to intervention of infection. After obtain L A removal of infected clot. Irrigation with normal saline or povidone iodine or hydrogen peroxide. Control of bleeding by pressure pack and sutures.
e. Then suitable antibiotics are the main treatment modalities as because the cause is due to infection.
f. Analgesics to relieve pain and above selected measures may be used.

Some Analytical Observation

Certain bleeding disorders should consider with careful judgment and consultation with hematologist, prior to extraction if removal of tooth is absolutely necessary. The main bleeding disorders are:

1. Hemophilia
2. Purpura
3. Leukemia

Hemophilia

a. If AHG is 25 to 50 percent of normal – patient do not suffer from bleeding unless major trauma and 10 to 25 percent with minor trauma.
b. CT shows within normal time limits with factor VIII above 1 to 2 percent, severe hemophilic have 0 percent AHG.
c. Replacement of factor VIII from:
   - Fresh whole blood.
   - Fresh and frozen plasma.
   - Cryoprecipitate AHG preserve from human plasma.
d. *Extraction method in case of hemophilia:* Anesthesia particularly block is absolutely contraindicated. Injection of LA can be given to the periodontal membrane that is Malamed intraligamentary anesthesia.
e. *GA:* Nasal inhalation after full pre-medication is satisfactory. Orotracheal tube is passed in direct vision. Diazepam 5 mg IV and pentozocin lactate 40 mg IV.
f. Preparation of hemorrhagic splint. Use of oxidized cellulose.
g. Extraction should be done with caution and should be atraumatic.
h. Squishing the socket and packing with white head varnish.

1. *Postoperative:* Patient is sitting position, absolute bed rest with no suture. No talking, no hot drinks, no aspirin, no alcohol. Apply barrel bandage liquid diet. Paracetamol for pain may be phenobarbiton Na 30 mg at night. During extraction injection of EACA in a dose of 0.1 gm per kg body weight.

Following extraction oral EACA 1gm per kg body weight for every 6 hours for seven to ten days. Morning of operation, transfusion of cryoprecipitate AHG to design to raise factor VIII level to 50 percent of normal. No further cryoprecipitate is given unless the patient bleeds (Rizza Regimen '74).

2. *Purpura:* Purpura is a bleeding disorder. The patient complains of bleeding following surgery. Consultation and clearance are mandatory from hematologist prior to surgery.
3. *Leukemia:* Avoid surgical procedure. Consultation and clearance are mandatory from hematologist prior to surgery if at all necessary.

Trismus

a. Postextraction trismus is mainly due to infection via the needle transmitted into the muscle plane.
b. Grazing of the needle, i.e. needle trauma causes injury to the soft tissues during block anesthesia.
c. Postextraction trismus may be due to persisting infection of the extracting tooth.
d. Management
   - Suitable antibiotic.
   - Anti-inflammatory analgesic.
   - Muscle relaxant (diazepam 5 mg at bed time for 7 to 10 days).
   - Frequent warm saline mouthwash.

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FOUR

Impaction

• Definition • Classification of Various Impactions Including Lower Third Molar, Upper Third Molar and Upper and Lower Canine • Importance of "WAR" Lines • Diagnosis • Clinical Features • Investigation • Various Treatment Modalities • Complications

Definition of Impaction

An *impacted tooth* is one, which fails to either erupt partially or totally in its normal place in the mouth due to inadequate of space, and obstruction of an adjacent tooth or teeth or soft tissue and bone, beyond its chronological age of eruption.

An *unerupted tooth* is the one, which has not perforated the oral mucosa, and a malposed tooth is one, which is in an abnormal position and may be erupted or un-erupted.

Berger suggested the following local and systemic causes of impaction.

Local Causes

1. Irregularity in the position and pressure of an adjacent tooth.
2. The density of the overlying and surrounding bone.
3. Long continued chronic inflammation with resultant increase in density of the overlying mucous membrane.
4. Lack of space due to underdeveloped jaw.
5. Unduly long retention of the primary teeth.
6. Premature loss of the primary teeth.
7. Acquired diseases such as necrosis due to infection or abscesses and inflammatory changes in the bone due to exanthematous diseases in children.

Systemic Causes

1. Prenatal causes
   a. Heredity
2. Postnatal causes: All those conditions that may interfere with the development of the child.
   a. Rickets
   b. Anaemia
   c. Congenital syphilis
   d. Tuberculosis
   e. Endocrine dysfunctions
   f. Malnutrition.
3. Rare condition:
   a. Cleidocranial dysostosis
   b. Progeria
   c. Achondroplasia
   d. Cleft palate.

The Consensus and the Criteria for Surgical Intervention for Removal of a Third Molar

1. Recurrent pericoronitis.
2. Caries not ameanable to restorative measure.
3. Dentigerous cyst.
4. Internal and external resorption.
5. Periodontal disease to which the third molar was contributing.

Sequence of Impaction of Teeth According to Harry Archer (1975)

1. Upper third molar
2. Lower third molar
3. Upper canine
4. Lower canine
5. Lower premolar
6. Upper premolar
7. Upper central incisor
8. Lower lateral incisor

Classifications of Lower Third Molar

According to GB Winter in the year 1925 who first devised a satisfactory classification of third molar on the basis of the long axis of the impacted third molar in relation to long axis of the second molar.

The position of the impacted tooth to the long axis of the second molar:

1. Vertical
2. Horizontal
3. Inverted
4. Mesioangular
5. Distoangular
6. Buccoverted
7. Lingeoverted
8. Unusual position

(Fig. 4.1)

Pell and Gregory classified lower third molar on the basis of relation of impacted tooth to ramus of the mandible and the second molar.

Class–I : Sufficient amount of space between the ramus of the distal of the second molar for the accommodation of the mesiodistal diameter of the crown of the third molar.

Class–II : The space between the ramus and the distal of the second molar less than the mesiodistal diameter of the crown of the third molar.

Class–III: All or most of the third molar within the ramus.

Relative Depth of the Third Molar in Bone

Position A : The highest portion of the tooth on a level with or above the occlusal line.

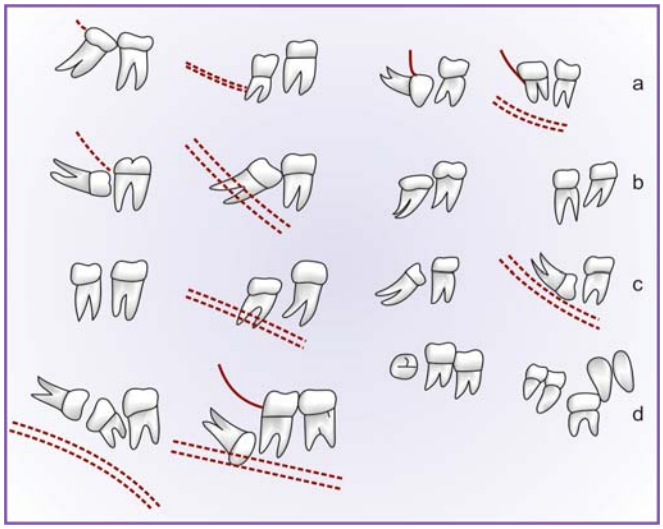


Fig. 4.1: Showing from top to bottom as follows: a. Class–I type A – mesioangular, vertical, horizontal distoangular. b. Class–II type B – horizontal, mesioangular, vertical, distoangular. c. Class–III type C – distoangular, vertical, mesioangular, horizontal. d. Rare positional or uncommon impaction

Position B : The highest portion of the tooth below the occlusal line, but above the cervical line of the second molar.

Position C : The highest portion of the tooth on a level with or below the cervical line of the second molar.

Some Considerations and Observations Regarding the Complications During Surgical Intervention

1. Abnormal root curvature
2. Hypercementosis
3. Proximity to the madibular canal
4. Bone density
5. Adipose tissue
6. Lack of accessibility
7. Inflexibility of the muscles of the mouth.

Diagnosis

A variety of symptoms ranging from atypical facial pain, extraoral discharging sinus, osteomyelitis, cyst, neoplasm to several types of infections involving various important anatomical spaces. The remarkable improvement in the field of radiology has enabled the dental surgeon to diagnose the situation with the help of varieties of X-rays ranging from periapical X-ray to orthopantomograph (OPG). Diagnosis should be based on thorough clinical examination supplemented by radiological examination (Killey Kay, 1975).

Clinical Examination

The offending lower third molar is usually associated with the following signs and symptoms.

1. Pain in the region of the tooth.
2. Swelling of the face on the affected side.
3. Increasing trismus.
4. Foetor oris.
5. Enlarged, tender, submandibular lymph gland.
6. Symptoms of acute pulpitis and even an acute alveolar abscess in case of caries in the distal surface of the second molar or third molar, itself, due to impaction of food debris in between the aforesaid teeth.
7. Buccal migratory abscess.
8. Submeseteric or infection involving other anatomical spaces of the face.
9. Extraoral discharging sinus, etc.

Radiographic Investigation

For diagnosis and assessment of lower third molar, detailed radiological investigation is needed for efficient guidance of the operative procedures. Not only the relative position angulations, root pattern, apical variation of the impacted lower third molar is assessed but also the relation between the roots and the inferior dental canal, texture of the bone, root pattern of the lower second molar need to be assessed radiologically.

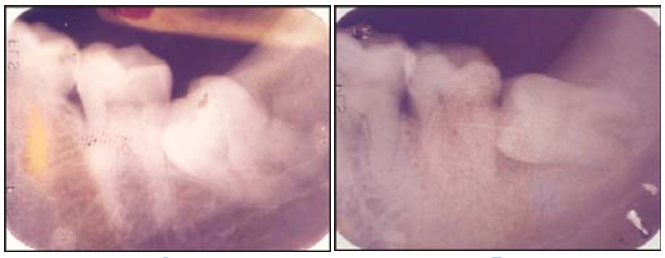
Radiological Investigation of Lower Third Molar

This includes the following varieties:

1. Periapical X-ray (I/O PA X-ray). P. A. projection and intraoral radiograph for demonstrating the anatomy of the tooth and the adjacent supporting bone.
2. Lateral oblique X-ray (preferably 30°)
3. Occlusal X-ray (intraoral)
4. Orthopantomogram (OPG)
5. Digital.

Periapical X-ray (I/O PA X-ray): This view is most suitable because it gives the accurate picture of that region for detail assessment needed for diagnosis and management. According to the report of the Howe and Payton (1960) intraoral periapical X-ray is the best radiograph to predict relationship of the inferior dental canal and root of the third molar. But the disadvantage of this X-ray as suggested by the many workers was inability to perform this X-ray in case of trismus (Figs 4.2A and B).

Lateral oblique X-ray (preferably 30°): It is considered to be a suitable substitute of periapical X-ray when periapical X-ray facility is not available or periapical radiograph cannot be taken due to trismus. However, this X-ray cannot give an accurate picture like the periapical X-ray.



A B

Figs 4.2A and B: (A) I/O periapical X-ray shows mesioangular impaction. (B) I/O periapical X-ray shows horizontal impaction

Occlusal X-ray (intraoral): Advantage of this view is that buccolingual relationship of the third molar can be visible in this view.

Orthopantomogram (OPG): The use of panoramic radiographs in the assessment of impacted and unerupted third molars have the advantage of examining and comparing both sides of the jaw on the same film. This enables the surgeon to classify the type of impaction and predict the difficulty of removal. However, panoramic radiograph has it limitations (Fig. 4.3).

Digital IO: Enlarged, colour image on screen in front of operating surgeon.

Radiographic Assessment

A standard periapical radiograph of the mandibular third molar region is mandatory.

Interpretation of the standardized intraoral radiograph was done in terms of following points:

1. Access
2. Position and depth
3. Angulation
4. Obliquity
5. Pattern
6. Crown shape
7. Inferior dental canal and
8. Bone texture
9. Root pattern of the lower second molar
10. Any pathology present or not.

WAR Lines of Winter (Fig. 4.4)

The position and depth of the impacted tooth within the mandible was determined by Winter's line. These were three imaginary line described as 'white', 'amber' and 'red' lines respectively. 'White' line was drawn along the occlusal surfaces of the empted mandibular

Fig. 4.3: OPG X-ray shows bilateral mesioangular impactions of the mandible and distoverted impaction of the left maxilla

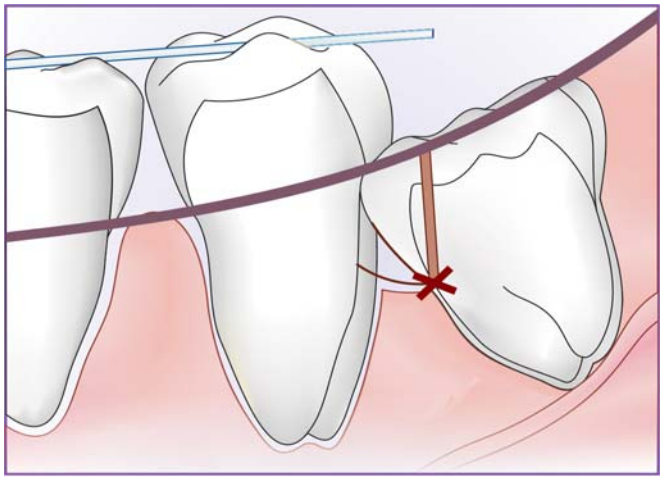


Fig. 4.4: WAR lines of Winter. W for white line, A for amber line, R for red line

molars and extended positively over the third molar region. This line indicates the depth of the impaction. The second imaginary line ('amber line') was drawn from the surface of the bone lying distal to the third molar to the crest of the interdental septum between first and second mandibular molars. It indicates the margin of the alveolar bone enclosing the tooth.

'Red' line was a perpendicular line drawn from the amber line to an imaginary 'point of application' for an elevator, a maximum convexity of impacted tooth. Howe opined that 1 mm increase length of the 'red' line caused three times difficult.

Several factors relating to anatomy, i.e. position, classification, and angulation of the third molar helps the surgeon to predict the difficulty of removal. Generally the deeper the impaction in bone, the more difficult it is to remove.

Seven radiological signs had been suggested by Howe and Payton (1960) as indicative of a close relationship between the mandibular third molar tooth and the inferior alveolar canal. Four of these signs were seen on the root of the tooth and the other three were changes in the appearance of the inferior alveolar canal. Following signs are explained below:

1. *Darkening of the root:* When there was impingement of the canal on the tooth root, there was loss of density of the root. The root appeared darker. Howe and Poyton (1960) reported that 93.1 percent of the teeth in "true relationship" to the canal showed this sign.
2. *Deflected root:* Deflected roots or roots hooked around the canal were seen as an abrupt, deviation of the root, when it reached the inferior alveolar canal. The root may be deflected to the buccal or lingual side or to both sides so that it may completely surround the canal.
3. *Narrowing of the root:* This sign appeared when the inferior alveolar canal crossed the apex and was identified by the double periodontal membrane shadow of the bifid apex.
4. *Interruption of the white line(s):* The white lines are the two radio-opaque lines that constitute the 'roof' and 'floor' of the inferior alveolar canal. These lines appeared on a radiograph due to the rather dense structure of the canal walls. The white line was considered to be interrupted if it disappeared immediately before it reached the tooth structure, either one or both lines might be involved. The interruption of the white line(s) was considered to indicate deep grooving of the root if it appeared along or perforation of the root if it appeared with the narrowing of the inferior alveolar canal (Seward 1963, Howe 1985). The interruption was considered by some to be a 'danger sign' of a true relationship between tooth root and canal.
5. *Diversion of the inferior alveolar canal:* The canal was considered to be diverted if while crossing the mandibular third molar, there was a change of its direction (Seward 1963, Kipp et al. 1980;) attributed an upward displacement of the inferior alveolar canal to the contents of the canal passing through the root ascend during eruption of the third molar, the contents are dragged upwards with it. Rud 1983 reported a 1 percent incidence of an upward deflection of the canal where it overlapped the root and 4 percent when the root was grooved.
6. *Narrowing of the inferior alveolar canal:* The inferior alveolar canal was considered to be narrowed when the root of the mandibular third molar was crossed by it and there was a reduction of its diameter (Poyton). This narrowing could be due to the downward displacement of the upper border of the canal or the displacement of the upper and lower borders towards each other with the hourglass appearance (Cogswell 1942, Rud 1983).
7. The hourglass form indicated a partial encirclement of the canal or a complete encirclement or it might mean either or these alternatives. Howe and Poyton (1960) reported 33.7 percent of teeth in a true relationship with the canal to have this sign.
8. "Bull's eye" appearance in impacted lower third molar.

Surgical Modalities

The various techniques of surgical removal of lower third molar were recommended by several authorities

like Sir William Kelsey Fry, Sir Terrance Ward. There are various methods of incision and flap design (Figs 4.5 and 4.6).

Three main types of incision were used:

1. 'L'-shaped,
2. Bayonet-shaped, and
3. Envelope incision and envelope flap.

'L' -Shaped Flap: Cited from Macgregor AJ 1985

This most commonly practice flap extends from a posterior limit just lateral to the ascending ramus to the sulcus. Incision distal to the second molar angled laterally along the ascending ramus on the bony support by carrying it from the lateral margin of the distolingual cusp of the second molar. The total length of the distal incision is around 2 cm.

Anterior limb is the vestibular extension at the level of second molar. If wider exposure is desired, it can be extended anteriorly upto the first molar. The junction between the limbs may be curved and the incision made in one sweep or it may be angled. This incision almost totally commits the operator to a buccal approach, as it is now difficult to raise a lingual flap.

Bayonet-Shaped Flap: Cited from Macgregor AJ 1985

The bayonet-shaped incision has three parts – distal; intermediate/gingival and anterior. In other words, it goes round the gingival margin of the second and even the first molar before turning into the sulcus.

Envelope Incision and Envelope Flap

In its posterior part, this incision tends to be placed more lingually. It joins the gingival margin of the second molar anywhere from the lingual to the buccal side.

The flaps should provide maximum visual and mechanical access. Variation in flap design include technique of detaching the buccal free gingival fibers around all the teeth forward to include the first molar and separating the large flap buccally.

The envelope flap design is reported to be very much satisfactory and convenient, and which is recommended by Walter Gurallnick 1968. It is also claimed this flap is easier to repair and has less postoperative complications.

Many types of flap design have been advocated by Archer 1975, Koemer 1994. Basically, all of them have a posterior and an anterior limb with or without an intermediate limb. The incision should not be extended too far distally to avoid:

i. Bleeding from the buccal vessels and anastomising branches of lingual and facial arteries.
ii. Careful to avoid damage to the temporalis muscle to avoid postoperative trismus.
iii. Herniation of buccal pad of fat into the operating field.

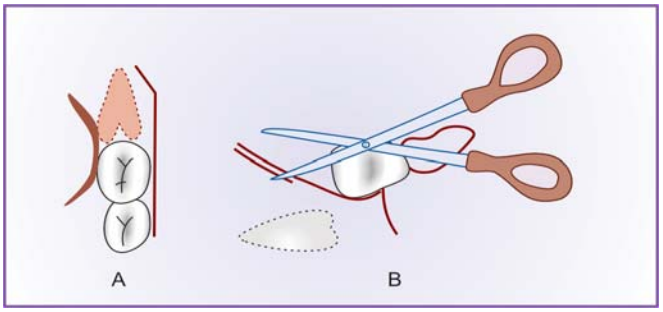
Difficulty index of impacted lower third molar

Angulation		*Depth*		*Ramus relationship/ space available*	
MAI	1	Level A	1	Class I	1
HI/TI	2	Level B	2	Class II	2
VI	3	Level C	3	Class III	3
DAI	4				

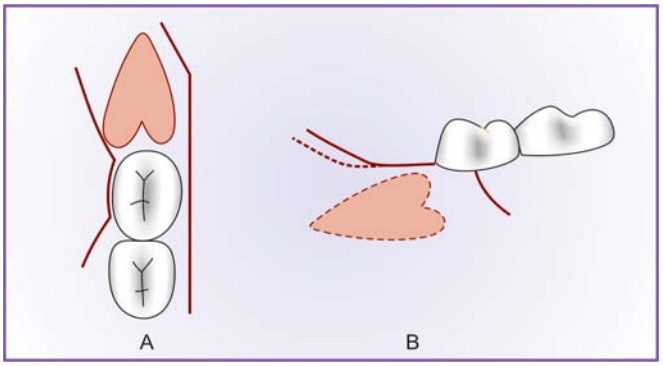
From the above table difficulty index may be calculated as follows:

More the number more difficult extraction

Example: DAI-4, Level B-2, Class II-2, Total score 8 that means 8 is the difficult extraction. Another example HI-2, Level C-3, Class III-3, Total score is 8, so difficult extraction.



Figs 4.5A and B: (A) Design of buccal flap for lower third molar: the distal extension follows the external oblique line of the mandible. (B) Use of scissors to extend the incision up the external oblique line



Figs 4.6A and B: Showing most commonly used envelope incision and the design of envelop flap

Ward's Incision

Sir TG Ward 1968, made some modification of the incision. The anterior line of the incision runs from the distal aspect of the second molar curving downward and forward to the level of the apex of the distal root of the first molar. The second type of incision is used when a linguoverted tooth impaction is present. The posterior part of the incision is the same but the anterior part commences as the junction of the anterior and middle thirds of the second molar and runs down to the apex of the distal root of the first molar.

Incision Used in Lateral Trepanation Technique or Removal of Developing Lower Third Molar by CB Henry, 1969

'S'-shaped incision was advocated from the retromolar fossa, across the external oblique ridge curving down through the attached mucoperiosterum to run along the reflection of the mucous membrane to the anterior border of the first permanent molar. Literature indicated to leave a cuff of attached mucoperiosteum 5 mm in width distobucally to the second molar.

Removal of Bone (Fig. 4.7)

Surgical removal of an impacted mandibular third molar involves bone, removal and there are two methods by which this is achieved using (a) chisels and mallet or (b) a surgical drill. Method of bone removal was developed by George B Winter and Glenn Bell, Boyd Gardner, T. Austin were among those who provided refinement to the technique of chisel instrumentation as an aid to dento-alveolar surgery from Kurt H Thoma.

In the mandibular third molar region, the grain of the bone runs in an anteroposterior direction in both lingual and buccal plate. Therefore, Ward 1956 advised to give a vertical stop cut at the mesial end of the portion of the bone to be removed to prevent accidental splitting of buccal alveolar plate enclosing the lower second molar.

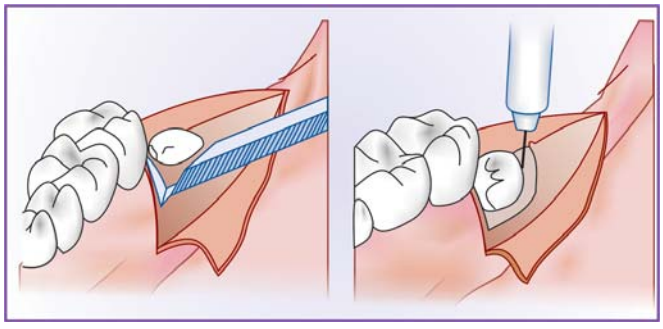


Fig. 4.7: Removal of buccal bone by chisel. Decapitation of the tooth by bur

Late Homer C Killey and LW Kay 1985 explained a slightly modified view and advised to establish to vertical stop cuts, one at the mesial limit of the bone to be removed and the other at the distant limit which was made at a similar depth.

A chisel has a bevel and a flat surface, which affects the direction in which the instrument cuts through the bone. In most instances, the chisel is used with the bevel towards bone to be sacrificed. However, in some cases, 'the use of bevel' may be different to overcome the difficulty of access in the lower third molar region.

Chisel provides a quick clean method of removing young elastic bone provided that the instrument is sharp and used skillfully. Incidence of postoperative complications like infection, acute alveolar osteitis, oedema etc. is less with the use of chisel. Healing of the bone is good Srinivasan 1994.

However, the chisel technique has certain disadvantages. It is different and patient's compliance is poor when used under local anesthesia. Chances of mandibular fracture are relatively high with the use of chisel. Furthermore, use of chisel may be restricted in case of deeply-buried impaction, impaction in edentulous jaw and in elderly patients Killy and Kay 1975 and Srinivasan 1994.

The other method of bone removal is with the help of a bur, the bone may be removed either piecemeal with a large bur size No 12 round bur or vulcanite burs or by the postage stamp method. In this technique, a small round bur No 3 is used to make a series of holes outlining the portion of the bone to be sacrificed and then joined up by either a bur or chisel cut. That is a neat ad precise method of bone removal. Cited from Prof G L Howe.

Another method of bone removal with the help of a bur, is "Guttering". This is done with the help of a No 6 round bur or No 10 rose head bur. A gutter is created in the bone along with the crown of the impacted tooth starting from the distolingual corner. This is an extremely useful technique for removal of the tooth or root as it leaves a ridge of buccal bone to serve as a fulcrum for an elevator during the delivery of tooth. Harris, Killey and Kay.

Bone removal with bur is a precise, efficient and useful technique—Thoma.

Lingual Split Bone Technique

The lingual split bone technique for removal of lower third molar was invented and introduced by Sir William Kelsey Fry who taught this method to many operators including Sir Terence G Ward who was a noted exponent and improviser and popularized this technique throughout the world.

The technique is based on special anatomical features of the third molar region. First, a vertical stop cut about 5 mm in height is made with a 3 mm width chisel in the buccal cortex immediately distal to the second molar. A second vertical stop cut will be made about 4 mm disto-buccal to the third molar crown. The two cuts will then be joined, and the buccal plate covering the crown will be removed.

When completed, the rectangular window should have a depth sufficient to permit insertion of an elevator beneath the mesial aspect of the impacted tooth. Any bone over the superior aspect of the crown will be then removed. Then the chisel will be placed on the inner side of the lingual plate at an angle of 45° to the upper border with its cutting edge paralle to the external oblique line and the bevel facing lingually. A light tap with a mallet will split off a portion of the lingual cortex, which will then be removed.

The above technique is modified by Davis et al 1983 and Lewis in 1980. Davis's technique mentions not to separate the mucoperiosteom from lingual area of bone. The bone was released in segments to allow tactile control of osteotome to prevent penetration of the osteotome into soft tissue. More than one osteotome per impaction was usually used to ensure sharp cutting edge. Wedging the osteotome between tooth and bone should be avoided to prevent fracture of the mandible (Figs 4.8 and 4.9).

Lewis Modifications

Flap: A limited buccal envelope flap was raised to avoid unnecessary stripping of the periosteum to avoid periodontal pocketing distal to the second molar.

Bone removal: A lingual stop cut was given immediately distal to the second molar with the help of a chisel. The chisel was advised to be held as parallel as possible to the long axis of the second molar (an angled chisel was preferred in terms of convenience).

Bowdler Henry 1969 described this method to remove any partially formed unerupted third molar from patients of 9 to 18 years of age. This technique is known as lateral trepanation.

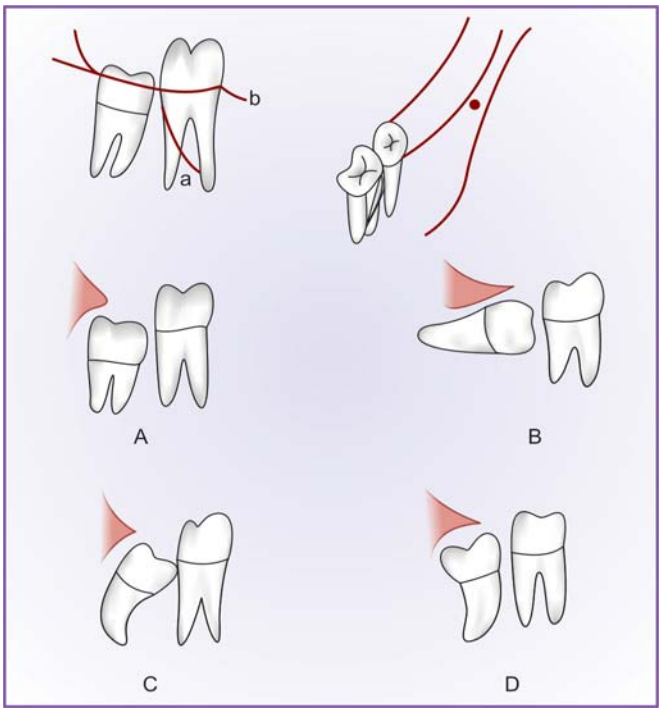


Fig. 4.8:

a. Outline of incision for raising a third molar buccal flap
b. Modification to create an envelope flap
A. Vertically-impacted third molar
B. Horizontally-impacted third molar
C. Mesioangular impaction of a third molar
D. Distoangular impaction of a third molar (Diagram from Prof Moore)

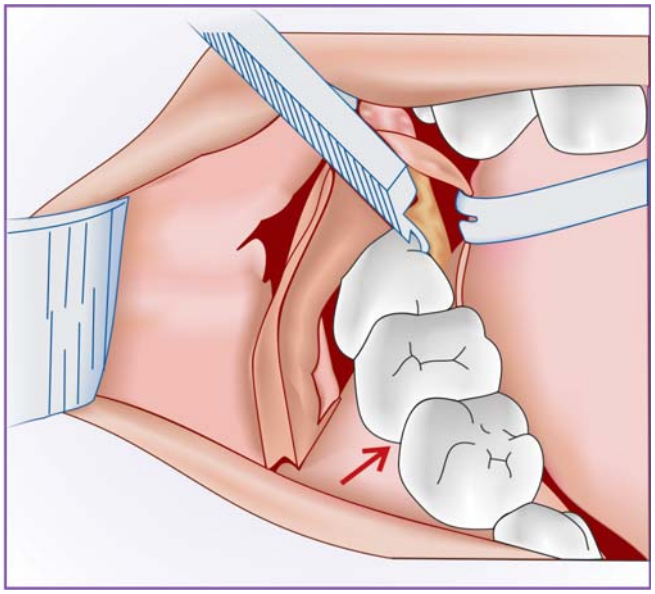


Fig. 4.9: The lingual split bone technique originally described by Sir William Kelsey Fry. Improvised and popularized all over the world by Sir Terence G Ward for removal of mandibular third molar

After reflection of this flap (incision described earlier) the soft tissues lying behind and below the incision were reflected from the bone, and held away with a Bowdler Henry retractor. A round together bone bun in a straight hand piece was used to make a vertical cut through the external plate at the anterior margin of the crypt. A second cut was made at the posterior end of the crypt at an angle of 45° from the row of trephine holes. Then a chisel was used to remove the buccal plate and the crypt was removed with the help of a Warwick James elevator.

The advantages of the technique described were excellent bone healing and no loss of alveolar bone around the second molar.

Different Surgical Modalities

This includes:

1. By buccal approach using chisel technique with or without decapitation.
2. By buccal approach using bur technique with or without decapitation of the tooth.
3. By lingual split bone technique with or without decapitation of the tooth (in case of decapitation of tooth bur is used or combination technique).

Outline of the Surgical Procedure

1. Incision and creation of the mucoperiosteal flap.
2. Removal of adequate amount of bone and establishment of point of application for elevator.
3. Delivery of the tooth from its socket with or without decapitation.
4. Trimming of the bone by a bone file or vulcanite bur.
5. Toileting of the socket with normal saline or povidone iodine solution.
6. Control of bleeding.
7. Closure of the wound by sutures.
8. Postoperative advice and prescription.

Incision and Creation of the Mucoperiosteal Flap

The incision having three parts:

Limb A: The anterior incision started from a point about 6.4 mm down in the buccal sulcus approximately at the junction of posterior and middle third of the second molar, passes upwards extended upto the distobuccal angel of the second molar at the gingival margin.

Outline of Removal of Different Lower Third Molar

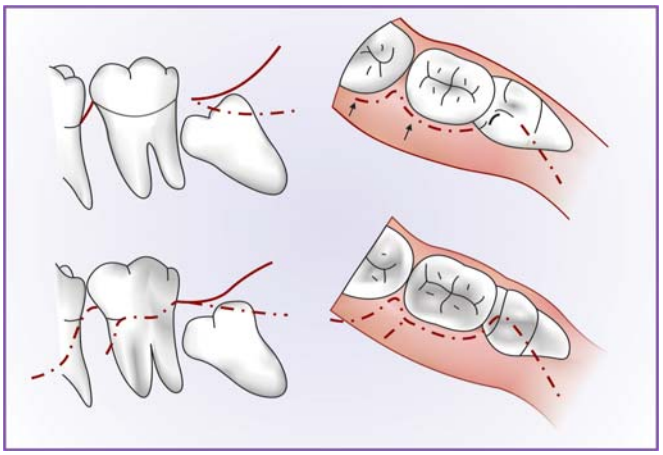
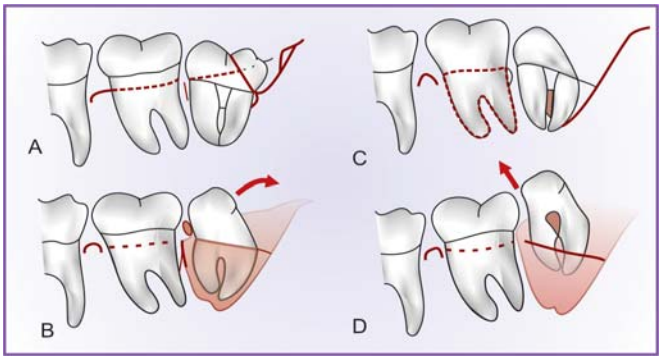


Fig. 4.10: The top diagram shows an envelope flap incision for lower left third molar depending upon the depth. It may be finished at one or other of the two arrows anteriorly. The bottom diagram shows the incisions for two-sided flap



Figs 4.11A to D: Removal of DAI of lower third molar (A) The crown is uncovered and the distal part split of with an osteotome. (B) This permit to access the distal bone, previously hidden by the bulbous distal part of the crown. (C) A straight elevator applied mesially to tilt the third molar clear of the second. (D) Buccal application of an elevator drives the tooth upwards and forwards out of the socket

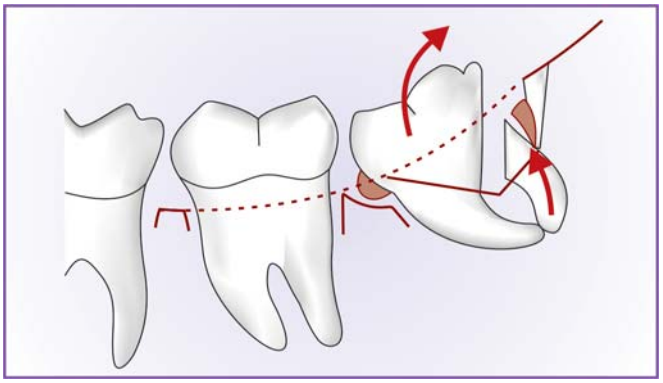


Fig. 4.12: Removal of MAI of lower third molar with curve roots by section of the distal root

Limb B: It was carried along the gingival crevice of the third molar extending upto the middle of exposed distal surface of the tooth.

Limb C: Started from a point where intermediate gingival incision ended and was carried laterally towards the cheek at mucosal depth.

In case of unerupted tooth when intermediate gingival incision was not needed. Then limb 'A' was extended upto the middle of the distal surface of the second molar.

Retraction of the Flap

1. Buccal and lingual flaps were reflected and then suitably retracted. Special care was taken to avoid any injury to the lingual nerve.
2. Removal of adequate amount of bone (discussed previously in detail).
3. *Delivery of the tooth/root:* The delivery of the tooth or root was achieved with the help of a suitable elevator.
4. Trimming of the bone by a bone file or vulcanite bur.
5. Toileting of the socket with normal saline or povidone iodine solution.

Control of Bleeding

The wound was packed with moist gauze for few minutes. After withdrawal of the pack if no active bleeding was detected (when haemostasis was achieved) the wound to be considered as ready for its closure.

Closure of the Wound by Sutures

All wounds were closed with two 000 black-braided silk sutures, one placed immediately distal to the second molar and one placed midway between the second molar and the end of the distal incision.

Postoperative Advice

1. Patients were advised to bite the pressure pack for one hour.
2. Cold and soft diet for first 24 hours.
3. Avoid vigorous mouthwashing for 24 hours, hot drinks, hot food and alcohol. Violent exercise or effort.
4. Application of ice extraorally for one hour after surgery.

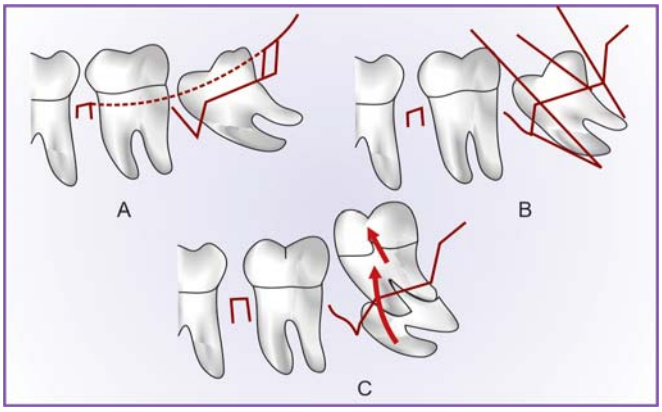


Fig. 4.13: Removal of MAI of left lower third molar. (A) Bone is removed below the greatest diameter of the crown and below the mesial convexity to make a point of application for a straight elevator. (B) Bone is removed distally to permit the tooth to be tilted. (C) It is elevated distally and then upward first by mesial application of a straight elevator and then buccal application of a curved one

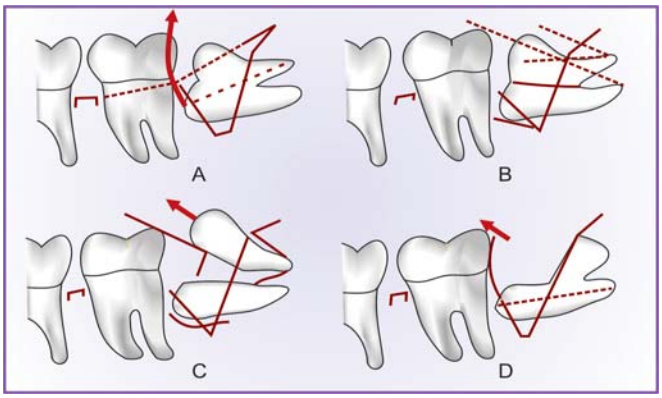


Fig. 4.14: Removal of a HI of lower third molar. (A) Bone is removed to expose the crown. With later mesial elevation it would rotate about the distal apex, but the mesial cusp would not clear the distal surface of second molar. (B) The tooth is divided longitudinally between the roots. The angle needed to tilt the distal half clear of the 2nd molar is determined and appropriate bone removed distally. (C) The distal half is elevated out. (D) The mesial half will now rotate about the mesial apex and clear the distal surface of the 2nd molar

If bleeding occurs :

1. Apply gauge pressure pack and bite it firmly.
2. Rest, sitting in an upright position.
3. Tablet Ethampsylate 500 mg twice daily about 24 to 48 hours.
4. If bleeding is not controlled by these measures contact concerned surgeon.
5. Hot saline mouthwash frequently after 24 hours.
6. Removal of upper third molar if present in future.

Surgical Steps of Prof Kapadia's Cunicular or Paragingival Single Flap, Distal End Incision for Impacted Lower Third Molar (Figs 4.15 to 4.24)

Fig. 4.15: Incision continued. Paragingival across from left second and first molar to distal of second molar if third molar not visible or distal third molar partly visible. The knife blade now changes to BP No 15 or can be continued with same No 11 blade, obliquely at an angle of 45º, down to and across the external oblique ridge of the mandible, down to the bone

Fig. 4.16: Showing completion of incision, which on reaching the end of the external oblique ridge then continues into soft tissue for about ½ to 1 cm into the soft tissue, but only at mucosal depth

Fig. 4.17: Total reflection of single buccal flap, and the spatulate end of the Howarth's periosteal elevator relaxing the lingual gingiva around impacted third molar to protect and retract the lingual nerve

Fig. 4.18: Complete exposure of operative field. Lingual nerve seen

Fig. 4.19: Buccal stop-cut dimensions, depth of 2 to 3 mm and length 5 to 7 mm depending on depth of roots of impacted third molar as seen in the x-ray

Fig. 4.20: Showing guttering of buccal plate of bone from end of stop-cut incision to distal of impacted third molar crown

Fig. 4.21: Showing continuation of buccal bone gutter to distal of third molar, but stopping short at the distolingual cusp of second molar, without injuring the lingual nerve

Fig. 4.22: Showing elevation of third molar with Coupland's elevator, from buccal aspect, taking support of the bony ledge of intact bone, left at distal of second molar

Fig. 4.23: Showing empty socket following removal of third molar

Fig. 4.24: Wound closure of the single flap, distal end or cunicular incision with two sutures

Prescription

1. A course of suitable antibiotics to prevent infection before surgery or postsurgery. Preferably cap. Amoxycillin 500 mg three times daily day before surgery to be continued five to seven days. In case of allergic to above drugs tab Erythromycin 500 mg four times daily.
   - Tablet metronidazole 400 mg twice daily after food for five days.
   - Chymoral forte one tablet three times daily half an hour before meal for at least three days to avoid postoperative oedema.
2. For relieving pain a suitable anti-inflammatory analgesics (preferably NSAI Drugs) at least 24 to 48 hours.

Classification of Impacted Upper Third Molar

Classification based on the long axis of the tooth within the bone in relation to the second molar:

1. M for mesioangular.
2. D for distoangular.
3. H for horizontal.
4. V for vertical.
5. DV for distoverted.
6. BV for buccoverted.
7. Inverted.

Another Classification Based on the Position of the Impacted Tooth and the Maxillary Air Sinus

The outline of maxillary air sinus looks like W and Y of Ennis.

1. If the tooth is situated near to the sinus it is called sinus approximation (SA)
2. If the tooth is situated away from the sinus it is called no sinus approximation (NSA)

Classification of Impacted Maxillary Canine

Class–I : When the impacted canine is located in the palate.

It may be again

- Vertical
- Semivertical
- Horizontal

According to Axial Inclination

Class–II : When the impacted canine is located in the labial or buccal surface.

Class–III : When the crown is situated in the palate and root is labial/buccal surface.

Class–IV : When the impacted canine located in the alveolar process between the lateral incisor and first premolar and its axis is usually vertical.

Class–V : When the impacted canine is located in the edentulous maxilla.

Class–VI : When the canine is placed in abnormal position, antral walls, infraorbital region.

Another Classification of Impacted Maxillary Canine

1. Labial position
   a. Crown is in intimate relationship with incisors
   b. Crown well above the apices of the incisors.
2. Palatal position
   a. Crown near surface in close relationship to roots of incisors.
   b. Crown deeply embedded in close relationship to apices of incisors.
3. Intermediate position
   a. Crown between lateral incisor and first premolar roots.
   b. Crown above those teeth with crown labially placed and root palatally placed or vice versa.
4. Unusual position
   a. In nasal or antral wall.
   b. Infraorbital region.

Diagnosis

1. On inspection, impacted canine may be visible partially or completely covered by mucosa or bone.
2. Absence of canine in the arch.
3. Bulge and or discharging sinus.
4. X-ray as IO parallax method.
5. Intraoral vertex occlusal X-ray.
6. Extraoral true lateral oblique view.

X-ray as IO Parallax Method

Two periapical X-rays of the same area are taken by moving the incident ray mesially or distally, by 5 degree angle. The interpretations are, the movement of canine along with tube, the canine is placed palatally.

The movement of canine opposite the tube. A canine placed labially or buccally.

Intraoral vertex occlusal X-ray: In this process, the central ray passes through the long axis of the central incisors. The cross-sectional views of the teeth are seen.

Extraoral true lateral oblique view: The crown of the impacted tooth lying in front of anterior surface of roots of central incisors—it is placed labially.

It lies behind the anterior surface of the roots of central incisors—it is placed palatally (Fig. 4.25).

Classification of Mandibular Impacted Canine

Classification is based on the finding of Field and Ackerman 1935. The mandibular impacted canine classified as vertical normally oblique and horizontal.

Rarely found canine impacted

1. Lower border of the mandible.
2. Bilateral canine impacted.
3. In mental protuberance area.
4. Migrated to the opposite side.

Surgical Modalities for Removal of Upper Third Molar

Assessment

Accessment is made difficult by the position of the upper third molar behind the second molar, the presence of the zygomatic buttress and the way which the coronoid comes forward when the mouth is open. Fortunately, in the majority cases, the molar is placed buccally covered by a thin layer of bone. The roots are often small and elongated and chances of fracture are easily. The roots or the whole tooth sometimes may be close to the maxillary sinus. This may pushed into the sinus or deeply placed disto angular teeth may create same problem as being pushed into the tuberosity.

In most of the cases, if the tooth and roots are favourable, placement and application of a straight Coupland elevator or straight Warwick James elevator are sufficient to remove the upper third molar.

The incision and flap sometimes require to start from the distul aspect of the maxillary tuberosity forward to the middle to the distal aspect of the second molar crown. This part of the incision should be kept over towards the palate to expose the third molar without raising a second palatal flap which is often difficult to retract and may cause retching in some patients. The incision is then taken round the neck of the second molar to midway along the buccal of its crown from which point it is carried obliquely forward into the buccal sulcus. The flap is reflected and held back with the periosteal elevator.

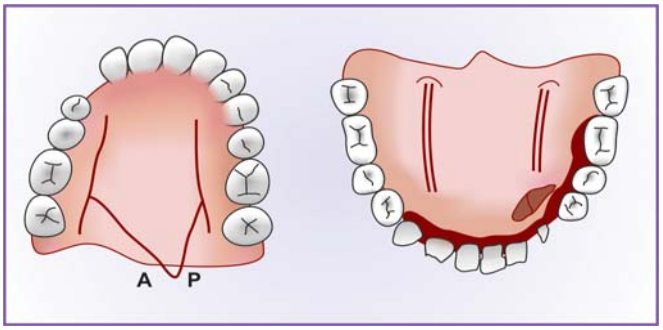


Fig. 4.25:
(A) The palatal flap, outline (in heavy print) of the incision for a palatal flap raised to expose a buried maxillary canine.
(P) Position of the palatine arteries (Diagram from Prof Moore)

Bone Removal

The bone over this tooth is usually quite thin and can be removed with burs or with a sharp chisel used with gentle pressure by hand to avoid accidentally pushing the tooth into the maxillary sinus. The placement of elevator should be gentle after creation of a point of application of the elevator. The other steps are same as mentioned before.

Surgical Modalities of Impacted Canine

Impacted Canine

- Exposure for orthodontic reason, discussed in separate chapter
- Removal of canine

Buccally-Placed Canine

These are extracted through a buccal incision, which is made in a long curve about 3 cm in length and at least half a centimeter above the gingival margin of the standing teeth. The thin layer of bone over the tooth is removed and the canine elevated from the socket by a Cryer's elevator and if it is disimpacted then it can be extracted with forceps.

Palatally-Placed Canine

The approach is via a palatal flap. The incision is made in the gingival crevice round the next of the standing teeth. For right-impacted canine it extents from the upper left canine to the upper right first molar. The raising of the mucoperiosteal flap is done without damaging the vessels, and the structure passing through the incisive foramen are preserve if possible. This may be divided if the access is restricted.

In case of bilateral canines to be removed. One, large flap is made from first molar to first molar.

Bone Removal

Bone is to be removed very accurately or carefully with a medium size rosehead bur (5–9) keeping to the palatal side of the buried tooth. Bone is removed until the crown is found. Then creation of a point of application of elevator, for removal of the tooth. Sometimes decapitation of tooth may be necessary for removal. Care about not to damaging the greater palatine artery, in case of injury to the vessels a measure recommended by late Quentein Royer known as stick tie should be taken.

Some Analytical Observations Regarding Impaction

1. Avoid the injury to the nutrient vessels present in the bony bed. In case of surgical trauma and consequent bleeding, crush the over lying bone with a blunt artery forceps as well as burnishing the bone and application of Horsley's bone wax.
2. Careful about accidental slippage of tooth or root during per-operative period to lingual pouch, post-pharyngeal space or accidental inhalation of tooth.
3. Interrupted suture is mandatory distal to second molar to prevent formation of a distal pocket, distal to the second molar, postsurgery.
4. Placement of Bevel towards the bone to be removed, otherwise Bevel's head causes Ischaemic Necrosis of the sound bone, and ultimately causes postoperative complications after removal.
5. Vertical stop cut is a mandatory dictum during bone removal of mandibular teeth. Saline or cool water irrigation necessary during removal of bone by bur to avoid the charring of bone.
6. Submeseteric space infection is more common in disto-angular impaction, as the insertion of the masseter muscles as the intermediate part is floating or loosely attached below (Bransby and Zachary), cited from Shafer. The infection and pus may tract the least resistance path under the masseter, which is attached to the lateral surface of the ramus of the mandible.
7. Migratory abscess of buccal sulcus is a complication of sub-acute pericoronitis. Pus may track buccally along the inner aspect of the buccinators and cause a discharging extraoral sinus in relation to the first molar and second pre molar.
8. Impacted lower third molars have the potential to spread infection in many directions: submandibular space via lingual plate, pterygomandibular space, lateral pharyngeal space and down the neck. Spreading laterally infection from the third molar may give severe trismus with an extension into the sub-meseteric space.
9. a. Vessels of the palate that can be severed during operations in this region. Ligation of the vessels by means of a *"stick tie"* through the entire mucoperiosteum will arrest bleeding (Fig. 4.26).
   b. Vessels located in the mucoperiosteum covering the lingual surface of the madibular alveolar ridge. The "stick tie" method will arrest bleeding from a torn vessel in this region as recommended by late Quentein Royer.
10. *Recurrent pericoronitis:* The pericoronitis as an infection or imflammation involving the soft tissues surrounding the crown of a partially erupted tooth commonly seen in a mandibular third molar. Affected male female ratios are same. Age mostly 18 to 25 years.

Pericoronitis

- Acute
- Sub-acute (importance migratory abscess of buccal sulcus)
- Chronic

The above-mentioned classification is based on the severity to moderate infection of the disease.

a. Severe throbbing intermittent pain which aggravated with mastication radiating to the adjacent area.
b. Difficulty in swallowing (dysphagia).
c. Difficulty to open the mouth (trismus).
d. Regional lymph adenopathy.

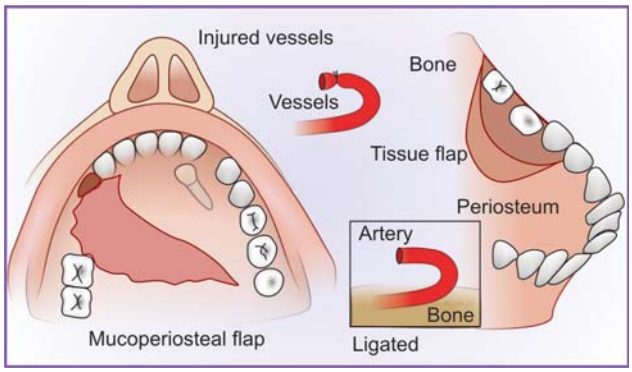


Fig. 4.26

e. Halitosis with milegrade of fever.
f. Ulceration or erosion may present in the area of gingival pad with cheek biting.

Treatment Modalities

a. Irrigation with warm normal saline.
b. Grinding of the offending maxillary third molar.
c. In case of pus, drainage, 30 to 40 percent trichlor acetic acid used as chemical cauterization for the covering operculum. Care should be taken the surrounding area must be guarded by cotton. To prevent the seepage of the chemical agent. Sometimes the TCA may cause a burning sensation to the surrounding tissues. In that case, glycerine will act as a soothing agent.
d. Suitable pain relieving medicine, and an antiseptic mouthwash (preferably chlorhexdine).
e. Suitable antibiotics.
f. Sometimes after obtaining local anesthesia removal of operculam is necessary (Operculectomy).
g. Removal of offending partially erupted or impacted third molar.

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FIVE

Common Precancerous Lesions and Oral Cancer

• Lesions Mention Briefly—Definition, Clinical Features, Probable Etiology and Management • Concepts of Tumor Immunology • Features of Oral Cancer • Radiological Appearance of Oral Cancer • Types of Intraoral Malignancies • Perioral Malignancies • TNM Classification • Recent Treatment Modalities

COMMON PRECANCEROUS LESIONS/CONDITIONS

1. Leukoplakia.
2. Carcinoma *in situ.*
3. Oral submucous fibrosis.
4. Erosive oral lichen planus.
5. Querat's erythoplakia.
6. Chronic interstitial glossitis in syphilis.
7. Sideropenic dysphagia (Plummer–Vinson syndrome/Kelly Patterason syndrome).

Leukoplakia

Leukoplakia is defined as a raised white patch or plaque, which cannot be scraped off easily and cannot be attributed to any other diagnosable disease clinically or pathologically (Fig. 5.1).

Pre-leukoplakia, a precursor stage of leukoplakia is a grey or greyish-white area with a slight lobular pattern and indistinct borders.

Fig. 5.1: Leukoplakia of cheek

Epidemiology reports available from studies conducted in different parts of India reveals the prevalence rate of leukoplakia from 0.2 to 8 percent.

Treatment Modalities of Leukoplakia
(Figs 5.2 to 5.5)

1. Maintenance of oral hygiene.
2. Oral prophylaxis.
3. Grinding of sharp and knife-edge tooth/teeth.
4. Removal of septic tooth, roots and oral sepsis.
5. Antioxidant.
6. High doses of isotretinoin (13–cis–ratinoicacid, a form of vitamin A) followed by a course of low dose isotretinoin or beta carotene have been reported to reduce eliminate some leukoplakic lesions. The capsule Selece-F is recommended.
7. Surgical ablation superficial surface to be removed (Burtlin's operation).

Fig. 5.2: Ice crystal formation following application of liquid nitrogen cryotherapy

Fig. 5.3: One hour after cryotherapy

Fig. 5.4: Necrotic slough after five days of liquid nitrogen cryotherapy

Fig. 5.5: The healing site after 45 days of liquid nitrogen cryotherapy

8. Mucoabrasive Surgery.
9. Surgical diathermy.
10. Cryosurgery and laser surgery.

Carcinoma *in situ*

This is a severegrades of epithelial dysplasia may merge into the lesion customarily designated as *'Carcinoma in situ'*– a lesion in which the whole thickness of the epithelium shows malignant cellular features. Prognosis is good in case of early detection and treatment.

Treatment Modalities CA in situ

1. Total excision, in case of small area.
2. Postsurgical management of lip lesions should include prescribing effective actinic blocking agents. The topical fluorouracil therapy has also been used successfully.
3. Laser excision, in case of wide spread areas recommended.

Oral Submucous Fibrosis

This is an insidious, chronic, complex disease affecting the mucosa of any part of the oral cavity.

Epidemiology prevalence of the diseases varies from 0.2 to 0.5 percent in India. The disease occurs almost exclusively among Indians, Pakistanis, Bangladeshis and Myanamaries, but sporadic cases have been deserved in China, Nepal, Thailand and South Vietnam.

The etiology of the diseases is still obscure but the following factors do have some conditioning effect on the oral mucosa:

1. Chewing of betel nut along with tobacco sometime with sweetners and condiments, rapped in betel leaf, the slaked lime act to realize and alkaloid (arecaidine) from the areca nut which ultimately causes mucosal rigidity of varied intensity. Nutritional deficiency increases the risk and severity of fibrosis.
2. Use of tobacco and lime.
3. Eating of excessive chilies (Capsaicin)
4. Protein and vitamin deficiency—specially vitamin A.
5. Autoimmune phenomenon.

Clinical Features

1. *Age:* Patients between 20 to 40 years mostly.
2. *Sex:* Females are affected more than males.

3. *Site:* Cheek, soft palate, lips, tongue, faucial pillars, pharynx and even oesophagus.
4. Continues discomfort with burning sensation during consuming meals and hot spicy foods.
5. Excessive salivation or dryness of the mouth.
6. Altered gustatory sensation.
7. Difficulties in chewing, swallowing, and speaking.
8. Progressive reduction of the oral opening.
9. Blanched opaque oral mucosa.
10. The uvula shrunk and appears as a small fibrous nodule.
11. Atrophy of the papilla of the tongue.
12. Stomatitis, vesicle formation and/ulceration of the oral mucosa—especially of the soft palate.
13. Small, slightly elevated, irregular, leukoplakic (white) spots on the lesion.
14. Occasional tenderness—especially in the ulcerated zones marks reduction in the movement of the soft palate and tongue.
15. Inabilities open the mouth of varying degrees (not trismus but pseudoankylosis according to Rowe's).
16. Presence of multiple fibrous bands involving cheek, soft palate, lips, and anterior facial pillars.
17. The mucosa may be dry, firm or leathery inconsistency.

Clinical Classification of OSMF

Oral submucous fibrosis may be classified into the following clinical stages depending on the degree of inability to open the mouth according to Rowe's Pseudo-ankylosis (Fig. 5.6).

1. *Very early stage:* Characterized by discomfort or burning sensation or ulceration in the mouth without the presence of inability to open the mouth.
2. *Early stage:* Characterized by initial stage of inability to open the mouth (oral opening is more than two fingers width) along with the above subjective features.
3. *Moderately advanced stage:* Characterized by moderate degree of inability to open the mouth (oral opening is less than two fingers) along with the above mention symptoms with difficulties in mastication.
4. *Advanced stage:* Characterized by development of complete pseudoankylosis.

Fig. 5.6: Oral submucous fibrosis with nodular leukoplakia

Treatment Modalities of OSMF (Based on Modified Dictum of Prof Ravindra M Mathur)

1. Removal of all pre-disposing factors, (omit spicy food, smoking, alcohol, pan parag, pan masala, khainy, gutka, betal nut chewing etc.).
2. Removal of upper and lower third molars.
3. Removal of septic tooth, roots and all oral sepsis.
4. Grinding of sharp edges of teeth.
5. Antioxidants, i.e. vitamin B complex with beta-carotina, selenium and zinc (one capsul daily).
6. Septilin 2 tabs three times a day (clinical experience shows encouraging results).
7. Aquasol A (water soluble vitamin A) once a day.
8. Injection placentrex (extract from human placentra. Fitalov's biological stimulant concept).
9. Placentrex gel application recently used.

Most satisfactory results obtain by intralesional injection of triamcinolone (macromolecule steroid helps long acting locally, the function mainly fibrolytic).

Recent studies showed that intralesional injection of Interferon gamma improved maximum mouth opening, reduced mucosal burning, increase suppleness of the buccal tissues.

Erosive Oral Lichen Planus

This is a chronic complex dermatologic disease with oral manifestations. It may occur in oral mucosa even in the absence of skin lesions (Fig. 5.7).

Epidemiology

The prevalence of oral lichen planus in India varies from 0.1 to 1.0 percent.

Fig. 5.7: Erosive oral lichen planus

Etiologic Factors

1. Anxiety.
2. Over work.
3. Traumatism.
4. Malnutrition.
5. Poor oral hygiene.
6. Chronic infection.
7. Immunologic factors.

This disease commonly affects the oral mucosa and lesions may occur in the mouth even in the absence of skin lesions. Females are affected more than the males, usual site, cheek, lip, anterior 2/3 of the tongue and soft palate. Usual age third to fifth decade of life with complain of irritation, itching, burning sensation during taking meal. Mucosal lesions, which are usually multiple, generally are seen as minute white papules that gradually enlarge and coalesce to form different patterns such as the reticular, annular, plaque-like and atrophic or erosive types. This also appears as white or yellowish-white lines arranged in a lace-like or filigree pattern. The characteristic features is the striae of Wickham, oral lichen planus is a prevalent disease in India. In some areas in South India 1.5 percent of the population suffer from this disease. The predilection site among Indians appears to be the posterior part of the buccal mucosa. Malignant transformation has been established in some cases of oral lichen planus.

Treatment Modalities of Erosive Oral Lichen Planus

1. Antiseptic mouthwashes—chlorhexidine, povidone, iodine.

Fig. 5.8: Querat's erythroplakia

2. Anxiolytic tranquilizer:
   - Diazepam 5 mg at bedtime.
   - Alprazolam 0.25 mg at bedtime.
3. Corticosteroids topical application—Triamcinolone/betamethasone.
4. Intralesional injection—Triamcinolone.
5. Antioxidant may routinely used (selenium zinc and beta-carotina with vitamin B complex).

Querat's Erythroplakia

This is a well-defined plaque or patch with a bright-red, velvety surface which cannot be corroborated clinically or pathologically to any other precancerous lesion. Oral Querat's erythroplakia is an uncommon disease in contrast with oral leukoplakia. This lesion also occur in addition to vagina and penis. Oral manifestation seen in cheek tongue and lip, etc. Querat's a French dermatologist reported first the above mentioned lesion (Fig. 5.8).

Treatment

It is a rare lesion sometimes needs excision.

Chronic Syphilitic Interstitial Glossitis

The chronic inflammation of the tongue (syphilitic glossitis) which associated with arteritis (inflammation of the arterial wall). Arteritis leads to proliferation of

the intima and narrowing or occulision of the lumen with resultant ischemia. The lingual papillae, therefore, atrophy leaving a bald tongue. Syphilitic glossitis is often associated with leukoplakia, and transformation to malignancy is high.

Treatment

Treatment includes confirmation of diagnosis of syphilis and treatment of syphilis along with anti-oxidant and vitamins.

Sideropenic Dysphagia (Plummer–Vinson Syndrome/Kelly Patterason Syndrome)

The oral manifestation atrophy of the papillae and bald spot of the tongue. Tender tongue with cheek difficult and swallowing (dysphagia), a feeling of food sticking in throat and leukoplakia of the oesophagus. It is commonly seen a middle aged women with iron deficiency anaemia. This symptom complex is called Plummer-Vinson syndrome.

Treatment

This includes:
1. Correction of iron deficiency anaemia.
2. Iron with vitamins.
3. High-protein diet and periodic check-up.

Some Important Predisposing Factors for Precancerous Conditions

These are summarized as follows:

6S

- Sharp tooth/teeth
- Sepsis
- Syphilis (syphilitic glossitis)
- Spirit (alcohol)
- Spicy food
- Smoking

ORAL CANCER

The clinical features of oral cancer are as follows:

Painless swelling or pain may be later, easily bleeds in advanced case restriction movements of tongue dysphagia, deysgesia (change in the test) changes in sensation (hyperasthesia, paresthesia, dysasthesia, paresis or any sorts of altered feelings). Symptoms of distant primary tumor. Inability to open the mouth either partially or totally (Trismus). The regional lymph nodes tender palpable even fixed. The appearance of malignant ulcer is rolled out everted margin. The patch or plaque in form of red or reddish-white exofytic (rough surface) ulcerated or non-ulcerated red, white, pink, brownish, bluish or black lesion.

Radiological Appearance of Oral Cancer

Radiolucency with ragged and vague borders band like widening of the PDL. Combination of radiolucent and radiopaque lesion with vague pattern. Radiopaque with vague border shows the sunburst appearance from the bone. Another important significance is the onion skin appearance from the border of the bone.

Types of Intraoral Malignancies

1. Verrucous carcinoma (Akermann's tumor)—This is a clinicopathologic entity exhibiting low-grade squamous cell carcinoma and having a striking association with the habit of chewing tobacco or using snuff and with a better prognosis than a squamous cell carcinoma (Figs 5.9 and 5.10).

Fig. 5.9: Verrucous carcinoma (Akermann's tumor)

Fig. 5.10: Squamous cell carcinoma

2. Squamous cell carcinoma (90-95 percent)
3. Malignant salivary gland tumor.
4. Mesenchymal, osteogenic sarcoma and chondrosarcomas.
5. Melanoma.
6. Intra-alv-epidermoid CA (Shear) retitle by WHO primary intraoral CA.
7. Malignant ameloblastoma.
8. Ameloblastic CA.
9. Systemic:
   a. Metastatic CA.
   b. Multiple myeloma.
   c. Lymphoma and leukemia.
   d. Kaposi's sarcoma.
10. Perioral malignancies:
   a. Cervical lymph node metastasis.
   b. Salivary MT of parotid, submandibular gland
   c. Basal cell CA of the face.
   d. MT of the maxillary air sinus.

TRIAGE OF LESIONS

- Low-suspicious treat and follow to observe disappearance within two weeks, upgrade if appropriate.
- Moderate-suspicious index: Referred immediately.
- High-suspicious index: Referred emergency measures.

Oral cancer is an epithelial neoplasia, thought to be developed in the antecedent mucosal epithelium. It generally begins near the basement membrane as a focal clonal overgrowth of latered stem cells, which expands upwards and laterally, replacing the normal epithelium.

The neoplastic process is a continuum beginning with normal epithelium progressing through: Hyperplasia → Dysplasia → Carcinoma *in situ* → Invasive carcinoma (Sirnath)

Carcinogenesis

The generic term for malignant epithelial tumor is carcinoma, and the common term used for all malignant tumors is cancer.

(Greek: Karkinos = A crab)

A satisfactory definition of tumor or a neoplasm would be "A mass of tissue formed as a result of abnormal, excessive, uncoordinated, autonomous and purposeless proliferation of cells" – Willis.

Carcinogenesis means induction of tumors.

Agents, which can induce tumors, are called carcinogens. The ultimate mechanisms, which caused cancer, that is, allow cells to proliferate continuously, break through normal bounds and invade tissues, remain unknown. The agents are usually:

- Chemical carcinogens
- Radiation
- Viruses

Theories of Carcinogenesis

The Genetic Theory

This is the most popular theory, which suggests that cells become neoplastic because of alteration in the DNA. The mutated cells transmit their characters to the next progeny of cells. Evidence in support of this theory comes from all types of aetiologic agents in carcinogenesis.

The Multistep Theory

This is the other well-accepted and documented theory. According to this theory, carcinogenesis is a multistep process. Example:

In chemical carcinogenesis, there are two essential features in proper sequence: initiation and promotion (propagation). Most cancers arise after several mutations, which have been acquired in proper sequence.

Table 5.1: Triage of lesions

	T *Primary tumor*		*N* *Lymph node status*		*M* *Distant metastases*	
T0	No evidence of primary tumor	N0	No nodes involved clinically	M0	Absent
T1	Greatest diameter < 2 cm	N1	Single ipsilateral node < 3 cm diameter	M1	Present
T2	Greatest diameter < 2 cm	N2	Single ipsilateral node > 3 cm and < 6 cm Multiple ipsilateral nodes < 6 cm		
T3	Greatest diameter > 4 cm	N3	Bilateral nodes or ipsilateral nodes > 6 cm		
T4	Tumor > 4 cm with gross local invasion				

Some cancers progress stepwise: An initial dysplastic change that may progress on to carcinoma *in situ* and then into invasive carcinoma.

Immune Surveillance Theory

This hypothesis suggests that an immune competent host mounts an attack on developing tumor cells to destroy them while an immune incompetent host fails to do so.

Monoclonal Hypothesis

Currently there is growing evidence that most cancers arise from a single clone of transformed cells.

However, no single theory can be implicated and in many tumors, more than one mechanism is involved in carcinogenesis.

Molecular approaches to cancer diagnosis can be considered from several different perspectives and molecular tests can also be discussed in terms of the variety of molecular markers that can be assessed for diagnostic purposes, and in terms of the different techniques used for detecting these markers (cited from Principal and Practice of Oncology by Jeffrey Sklar).

Thus, the accuracy, sensitivity and inherent advantage of using molecular markers can be summed up as follows:

Molecular markers are used:

1. For primary diagnosis of cancer.
2. For sensitive staging of cancer.
3. For informing prognosis of a case.
4. For the biologic behaviour expected of a particular tumor.
5. For monitoring residual disease after therapy.
6. For detecting possible predisposition for developing certain cancer.
7. The molecular markers commonly used in oral squamous cell carcinoma:
   a. c–mye oncogene
   b. The proliferating cell nuclear antigen (PCNA).

TUMOR IMMUNOLOGY

Apart from loosing control of cell division, a malignant cell may develop other abnormalities including formation of new or altered proteins. These proteins may be recognized by the host's immune system as foreign antigens. Two types of tumor antigens can be seen on tumor cells.

1. *Tumor-specific antigens (TSA)* are present only in tumor cells. Virally-induced tumor cells generally have antigens, that are shared by all tumors induced by same virus, whereas, tumors induced by chemical carcinogen have antigens not shared by other tumors induced by the same chemical even in the same animal.
2. The other type is a *tumor-associated antigen,* that is present in tumor cells and also in normal tissues, e.g. oncofoetal antigens. Oncofoetal antigens are present during normal foetal development but are absent or very difficult to detect in normal adult tissues. Some of these antigens can be detected in some malignancies and other diseases. Examples of these antigens are:
   a. *Carcinoembryonic antigen* is found on normal foetal intestine and human colon cancer, smokers, and patients with cirrhosis. It is most useful in monitoring the activity of disease in recurrent colorectal cancer.
   b. *Alpha-foeto protein* is normally made by yolk sac and liver cells of human foetus. It is also found in the serum of liver cancer patients and is a sensitive maker for disease activity. However, it is not specific and can be elevated in viral hepatitis.

Immune response to tumor antigens: The major mechanism of tumor cell lysis is NK cells and cytotoxic T-cells. However, macrophages and antibodies also participate.

Three major types of antibody associated with tumor immunity are: Cytotoxic Ab, blocking Ab, and unblocking Ab (the last two are controversial).

According to the concept of *immune surveillance,* the immune system detects tumor cells and destroys them before a tumor can form. The evidence supporting this theory is provided by the observation that, immunodeficient persons have a higher incidence of lymphosarcomas and leukaemias. However, the occurrence of cancers in otherwise immunocompetent humans indicates existence of escape mechanisms from immune system. Some of these are as follows:

Immunosuppression, especially in tumors of lymphoid system is common.

Blocking antibodies, large amount of tumor antigens, immune complex (ab+tumor antigen) may block the host's immune response against tumor antigen.

There may be loss or reduced expression MHC antigen.

It is thought, that, a better understanding of the interaction of cancer cells and host immune system will lead towards effective immunotherapy of cancer. Several methods are being studied now and that includes:

1. Immunostimulation by BCG, interferons, interleukins, lymphokine activated cells (LAK), tumor infiltrating lymphocyte (TIL).
2. Passive immunization with monoclonal conjugated with cytotoxin.
3. Active immunization with cancer cells.

Immunological perspective of oral sq cells CA—shows wide range in the inflammatory response. The plasmolymphatic response of the stromal reaction together with the mode and stage of invasion and vascular invasion (all are representing tumor host relationship) have been combined with features of tumor cells population (appearance, keratinization, nuclear differentiation and mitosis).

It is also been demonstrated (1) that blast transformation of peripheral blood lymphocytes, as well as the percentage of T-cells in peripheral blood, is significantly, lowered in patients with oral carcinomas compared to normal subjects, and (2) that serum from tumor patients had an inhibiting effect on transformation of lymphocytes in normal subjects (Bier et al, 1977).

Diagnostic Procedures

1. Oral exfoliative cytology
2. Toluidine blue test
3. ** Biopsy
   - Incisional
   - Excisional
   - Punch
   - Drill
   - Fine needle aspiration cytology
   - Frozen section (In case of cryosurgery)

Etiopathological Observation of Oral Squamous Cell CA

The cause of oral squamous cell carcinoma is unknown. Ill-fitting oral prostheses, actinic radiation, smoking, jagged teeth, syphilitic glossitis, and alcoholism, however, are believed to play a role in its production. Smoking is believed to be an important factor not only in the production of oral cancer, but also in the development of a second tumor after the first one has been cured.

Border's Classification

Border classified the tumor (Squamous cell CA or any other cancer) according to the degree of differentiation of malignancy in an ascending order.

- In Grade- I tumors, 75 percent or more of the cells are normally differentiated.
- In Grade-II tumors, 50 to 75 percent are normally differentiated.
- In Grade-III tumors, from 25 to 50 percent are normally differentiated.
- In Grade-IV tumors, from 0 to 25 percent are normally differentiated.

As a rule, carcinomas of the lip are better differentiated than those within the month. Of the latter, the carcinomas of the tongue and of the floor of the mouth are least differentiated. Squamous cell carcinoma of the oral regions metastasizes to the regional lymph nodes and only later to the distant organs.

The erosion is shallow crater involving the surface epithelium and the ulcer is deep crater damaging the whole surface epithelium and involving the underlying the connective tissue.

Classic Features of Malignant Ulcer

1. Nodular
2. Lobulated
3. Papillary
4. Fungative
5. Ulcerative
6. Deep after infection of tissues
7. Rolled out everted margins
8. Pain, referred pain to ear
9. Pain during swallowing
10. Salivation
11. Dysphagia
12. Is able to articulate
13. Halitosis
14. Local spread via lymphatic
15. A lump in the neck, which is palpable and tender may or may not be fixed.

** Discussed in detail in subsequent chapter six.

Treatment Modalities of Oral Cancer

Surgery, which includes:
1. Blade
2. Laser
3. Electrocautery (Surgical diathermy)
4. Cryosurgery
5. Surgery with block dissection.

The importance of lymphatic drainage of tongue for metastasis of carcinoma via the cervical lymph nodes the following diagram will help to understand the drainage system of the tongue and involvement of cervical lymph nodes and spread (Fig. 5.11).

Radical Neck Dissection

Remove the cervical lymphatic channels and in order to eradicate regional metastatic disease as originally described by Crile dissection was usually perform after the tumor was controlled by radiation therapy. However, theory today dictates that resection of the primary cancer and neck dissection occur simultaneously either in continuity or enblock.

Composite resection and commando operation. Radiation therapy either pre or postoperatively as an adjunct to surgical treatment.

Clinical Staging of Cervical Lymph Nodes Metastasis by Anderson

N_0 : Negative
N_x : Single excise
N_1 : Single node < 3 cm
N_2A : Single node > 3 cm
N_2B : Multiple unilateral nodes
N_3A : Unilateral fixed nodes
N_3B : Bilateral nodes

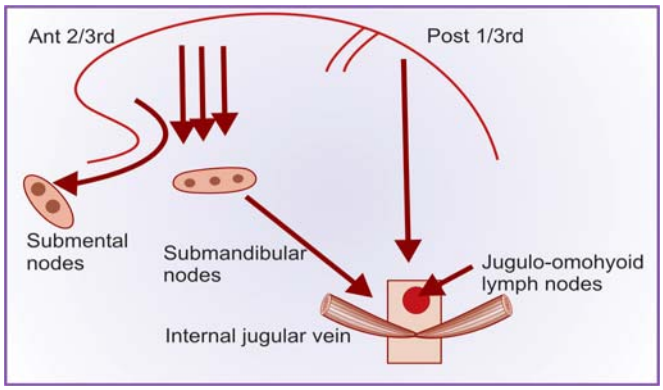

Fig. 5.11: Lymphatic drainage of tongue

Various Incisions Recommended for Radical Neck Dissection are Follows

1. Crile T incision
2. Martin double Y incision (one is straight and other is inverted)
3. Mcfee double ladder incision (exposure is good repair also good)
4. Ward Y incision
5. Hockey stick incision or reversed J incision (it is combined parotidectomy and block dissection).

Chemotherapy (Seldom Use Alone)

Common chemotherapeutic agents used:
1. 5-Flurouracil
2. Cisplatin
3. Methotrexate
4. Cyclophosphamide
5. Adriamycin
6. Bleomycin

Chemotherapy via superior temporal artery by perfusion technique recommended by PY Holoye. Bleomycin for four days infusion, then after 24 hours rest followed by cyclophosphamide vincristin (Oncovin) methotrexate and 5-flurouracil (BCOMF) another alternative BCMF, surgical adjunct radiotherapy.

Irradiation (External or Interstitial)

Radiotherapy by external beam :
1. Cobalt
2. Caesium

Interstitial irradiation technique with ^{137}caesium ^{192}iridium hairpins and looped are used.

External and interstitial therapy the dose reciprocity relationship to tumor size.

Tumor diameter	*Radiation dose (c Gy) External Beam*	*Implant*
<1 cm	0	7,000 – 7,500
>1 cm but < 2 cm	3,000	4,000 – 4,500
>2 cm but < 3 cm	4,500	2,500 – 3,000
>3 cm	5,500	0

Assuming 275 to 300 c Gy per fraction 5 fractions per week according to Stfford and Waldron 89.

Surgery with Radiation with Neck 4000 – 4500 r

Before radiation 11 percent carbamide per oxide dissolved in 9 percent mepivacaine HCl intratumoral

injection to improve the oxygenation of tumor cells-(Bragg method) Pizer. The idea prior to radiation the above treatment may help better acceptance of radiation. Co – 60 needle @ 200 r in one treatment tissue dose repeated two to three weeks.

Immunotherapy (Clinical trial)

Major Complication of Oral Cancer Treatment

1. Surgical defects lead to aesthetics and functional problems.
2. Radiation caries and dental infection, osteomyelitis and osteoradionecrosis.
3. Soft tissue infection may be bacterial fungal and viral.
4. Mucositis.
5. Xerostomia (Dryness of the mouth).

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SIX

Biopsy

• Definition • Various Types • Principles • Instruments • Importance as a Diagnostic Aid in Oral and Maxillofacial Surgery

DEFINITION

Biopsy is the histopathological study of tissues remove from leaving body, for confirmative diagnosis for evaluating the cancerous or pre-cancerous nature of a lesion. It can be of various types:

1. Incisional biopsy
2. Excisional biopsy
3. Aspiration biopsy
4. Drill biopsy
5. Punch biopsy
6. Exfoliative cytology
7. Fine needle aspiration cytology

Principles of Biopsy

1. Select most suspicious area, which may turn into malignancy.
2. Avoid necrotic ulcerative area of the lesion.
3. Local anesthesia to be injected the surrounding areas.
4. Include normal tissue margin, should be straight not beveled.

Instruments for Biopsy

The instruments required for procedures are:

1. Non-serrated tweezer
2. Curved scissor
3. Bard Parkar blade no. 11
4. Bard Parkar handle no. 3
5. Five mm biopsy punch
6. Disposable syringe with needle 26 G
7. Two percent Lignocaine HCl with 1: 80000 Adrenaline HCl (3–5 ml)
8. Suture material 000 black silk
9. Needle (½ inch, ½ circle curve cutting needle)
10. Ellis artery forceps
11. Fixative solution (10% Formosaline).

Incisional Biopsy

Incisional biopsy used when the lesion is large and irregular, and there is a need to study the border zone of the lesion. An incision biopsy should always include tumor tissue, border zone and adjacent normal mucosa.

Excisional Biopsy

It is the removal of the lesion into, for histopathologic examination. Lesions of 1 cm or less are ideal for this type of procedure.

Aspiration Biopsy

It is useful in deep-seated inaccessible sites. This is performing by using a large caliber needle and a glass syringe. It is used for cystic lesions to identify the true nature of the contents of the fluid.

Examples: Straw colour of fluid in case of dentigerous cyst. Shining appearance of the keratin fluid and peculiar smell and viscosity of the same, in case of odontogenic keratocyst. Wine colour of the aspirated fluid suggested the cystic ameloblastoma and the aspirated frank blood suggested hemorrogeic lesiosn like aneurysmal bone cyst AVS hemorrhagic bone cyst or central haemangioma.

Drill Biopsy

It is rarely done in case of central lesions that mean the pathology within the bone. The incision was made on the overlying mucosa and makes a window by use of drill to collect the tissue for the histopathological study.

Punch Biopsy

It is advocated when the lesion is uniform in appearance, the area to be biopsied is not very large

and when the adjacent normal tissue is not required for histologic examination or for comparison.

Exfoliative Cytology

It is the study of superficial cells, which have been either exfoliated or shaded naturally from mucous membrane. It is quick lab procedure to evaluate mass screening of oral cancer. Exfoliative cytology easy quick procedure, local anesthesia not required. Common staining can be applied. Unsuitable for diagnosis for malignancy. No significant complication.

Evaluates vesicular lesion study of the oral epithelium changes followed by chemotherapy.

Contraindication: Deep-seated lesion and fibrous lesion.

Papanicolaou and trum stain: Interpretation of exfoliative cytology as follow:

- Non-keratinised deeper cells—blue
- Non-keratinised superficial cells—yellow
- Keratinised cells—red.

Exfoliative cytology interpretation

Class I : Normal cells
Class II : Presence of minor atypia
Class III : The cells wider atypia may be suggested cancer
Class IV : Suggestive cancer
Class V : Positive for cancer and biopsy is mandatory.

Fine Needle Aspiration Cytology

Advocated by Ward in 1912, simple, safe, fast, inexpensive, atraumatic, dependable and effective method of tissue sampling for pre paroperative diagnostic technique, with Silverman needle. It is possible to get a strip of intact tissue 1.5 mm width and 1.5 cm long which can be sectioned and studied like normal biopsy. A 21-gauge needle is inserted into the lesion and cells aspirated and smeared in a slide. Rapid and effective acid cells fixation, stained and examine very quickly. For deep lesions, ultrasound or radiological guideline may be insured that the needle enters the lesion.

Advantage: The needle divided the structures than cutting through them. Lever and Trott in 1985 have given another useful extension FNAC or biopsy which is transoral aspiration cytology, in sebaceous lesions oral cavity and destructive jawbone lesions.

Immunostaining procedure: Quite encouraging method for histological diagnosis.

SEVEN

TM Joint and Its Diseases

• Anatomical and Physiological Aspects • Discussions of Various Diseases Involving TM Joint • Hypermobility • Subluxation • Luxation • Dislocation • Arthritis • Arthrosis • TMJDS/MPDS/Facial Arthomyalgia • Trismus and Ankylosis of TM Joint • Classification of Trismus and Ankylosis • Comparative Studies and Its Importance • Rational Management Including Medicinal, Surgery and Arthroscopy

ANATOMICAL AND PHYSIOLOGICAL ASPECTS OF TM JOINT

Anatomical Consideration

TM Joint is a unique joint according to structural anatomy and function. Though it is a two joints (R and L) but when it act as a unit of joint.

According to Harry Sicher, it is called a cranio-mandibular joint. It is like an atlanto-occipital joint. Again the one side of the joint is divided into two joints by the meniscus or articular disc.

1. Temporal meniscus joint.
2. Mandibular meniscus joint.

The TM joint is a joint, which is formed by head of the condyle and glenoid fossa of the temporal bone. According to Cunninghum, it is called glynglimoarthroidal joint (sliding hinge joint). TM joint type condyloid subtype synovial structurally and modified hinge joint functionally.

The component of TM joint: The articular disc or meniscus. Articular disc previously called as fibro-cartilagenous disc. Nowadays it is called as fibrous capsule. Sometimes it is considered as extention of the lateral pterygoid muscle. It is an oval shape thick in the periphery, thin in the centre. Upper border is concavo-convex and the lower border is concave to accommodate to the head of the condyle. It is surrounded by synovial membrane and the synovial fluid provides nutrition, lubrication and act as shock absorbers of the joint.

The following ligaments are essential components of TM joint.

1. Fibrous capsule.
2. Lateral ligament or temperomandibular ligament.
3. Sphenomandibular ligament.
4. Stylomandibular ligament.
5. Mandibular-malleolus ligament or ligament of Pinto.
6. Fibrous capsule surrounding articular tubercle circumferential mandibular fossa and lateral and squamatymphanic fissure below it is attached with neck of the mandible. Fibrous capsule is loose above the disc and tight below it.
7. *Lateral ligament*: It reinforces and strengthing the fibrous capsule. It is attached in the articular tubercle in the roof of the zygoma. Below it is attached posterior and lateral aspect of the neck of the mandible.
8. *Sphenomandibular ligament*: It derives from first branchial arch. It is arises from the spine of the sphenoid. It is attached below inferiorly in the lingualae of the mandible.
9. *Stylomandibular ligament*: Arises from the lateral aspect the styloid process of temporal bone. Below it is attached inner surface of the ramus and angle of the mandible.
10. *Arterial supply*: Superior temporal artery of ECA branch.
11. Mesenteric branch of maxillary artery.
12. *Nerve supply*: Auriculotemporal nerve of posterior division of mandibular nerve.
13. Mesenteric nerve of anterior division of mandibular nerve.

Physiological Concept

A reflex arc mechanism is present involving sensory nerves of the capsule and posterior attachment of the meniscus and motor fibers of the muscles of

mastication, primarily the external pterygoid muscle. It is thought that prematurities or decreased vertical dimension cause the condyle to exert pressure on the sensitive loose connective tissue attached to the posterior aspect of the articular disc. This results in triggering a reflex nerve arc to relieve the pressure, which may results in dislocation (Schwartz, Miller and Murphy et al).

Wyke's concept is that all the synovial joints of the body are provided with a quadruple array of corpuscular (mechanoreceptors) and noncorpuscular (nociceptor) receptor endings with individually characteristic properties of behaviour and different distributions in the articular tissues. TMJ also has four receptor systems. Type I, II and III are mechanoreceptors and Type IV is nociceptive. According to Mariano Rocabado (83) Type I mechanoreceptors assisted by type II contribute to reflex regulation of postural movement and to perpetual awareness of mandibular position.

Hypermobility

According to Ralph G Merrill (92), hypermobility of temporomandibular joint is characterized by excessive anterior movement of the condyle in all directions. As mentioned by Mr Zetz and HB Kaufman (80) the term "hypermobility" is very much confusing when used to the TMJ. Because it is more likely a normal condition rather than pathology for a large segment of population. As stated by DM Laskin (80), radiographically the condyle may be translated anterior to the eminence as far as 5 mm. This radiologic feature may not be diagnostic of any pathology, i.e. subluxation or dislocation. According to Laskin (80), Zetz and Kaufman (80), because the individual showing this sign may absolutely asymptomatic.

Subluxation

Subluxation defined as a self-reducing derangement between the articulating components of a joint that is associated with symptoms of pain, clicking or momentary locking, Laskin (80).

Subluxation as a partial dislocation of the joint with temporary locking of the jaw which is self-reducing Langdon et al (91).

According to Merrill (92), in subluxation of the temporomandibular joint the articular surfaces maintain partial contact and the condyle is able to return to the glenoid fossa voluntarily or aided by self-manipulation.

The terms 'luxation' and 'dislocation' are synonymous.

Laskin (80) defined dislocation as, it is a derangement between the articulating components of a joint that is not self-reducing.

As stated by MG Lawlor (82) dislocation is defined as a displacement of the condyle in front of the articular eminence where it is held by spasm of the muscles of mastication.

Dislocation of the temporomandibular joint occurs when the condylar head travels anterior to the articular eminence on maximal incisal opening and becomes locked in front of the eminence such that the patient is unable to close the mouth.

Clinical Classification

William Irby, the famous American authority classified the various abnormalities associated the excessive forward movement of the condylar heads which as follows:

1. Hypermobility (subluxation) without pain.
2. Hypermobility (subluxation) with pain.
3. Habitual dislocation (can be reduced by the patient).
4. Fixed dislocation (can not be reduced by the patient).
5. Acute or initial dislocation (the first dislocation, which generally can not be reduced by the patient).
6. Chronic or recurrent dislocation (dislocation that tend to recur on a periodic basis and generally can not be reduced by the patient).
7. Permanent or prolonged dislocation (dislocation of the condyle or condyles that has persisted for a significant period of time without reduction).

Millar Murphy et al and Tiecke consider certain predisposing factors for TM joint dislocation.

1. Birth-related forceps delivery and congenital weakness of the articular ligaments.
2. Traumatogenic.
3. Iatrogenic. Which includes:
   a. Prolonged dental procedures.
   b. Traumatic dental extractions.
   c. Injudicious use of mouth prop.
   d. Manipulation under general anesthesia.
   e. Improper use of laryngoscope or bronchoscope.
4. Drug: Reserpine and henothiazines.
5. Physiologic:
   a. Yawning.
   b. Sneezing.
   c. Extreme opening.

6. Systemic: Epilepsy and other involuntary muscle contractions.
7. Long-term over-closures secondary to loss of dentition as a result of loosening of the joint capsule.

Radiographic evaluation: OPG demonstrates dislocation as the condylar head is anterior to the articular tubercle after maximum oral opening (Lawlor, 80).

Lateral oblique transcranial radiograph and lateral tomograms (Merrill 92) are important in identification and documentation of dislocation. The condyle becomes superior and anterior in luxations and subluxations.

Treatment Modalities

Conservative Method

1. Reduced condyle by Hippocrates recommended measures. Dislocation can usually reduced by inducing downward pressure by both thumbs on the posterior teeth and subsequent upward pressure on the chin by remaining fingers. Simultaneously pushing posteriorly of the entire mandible. The operator should stand in front of the patient.
2. Rest of the joint. Sometime immobilization may be needed.
3. External heat.
4. Vapocoolant spray.
5. Short-wave diathermy.
6. Analgesics, muscle relaxants and sedatives.
7. Occlusal adjustment by grinding the tooth (according to *Law of Bull,* i.e. buccal cusp of upper and lingual cusp of lower).
8. Physiotherapy in the form of exercise.
9. Intra-articular injection of corticosteroid (sometimes recommended).

Surgical Methods

Operation for recurrent dislocation (Figs 7.1 to 7.9):

1. Capsule tightening procedure.
   a. *Chemical capsulorrhaphy*: Use of injection, 5 percent sodium psylliate or sodium tetradecyl sulphate.
   b. *Surgical capsulorrhaphy*: Tightening the capsule by sutures.
2. *Lateral pterygoid myotomy* (Laskin 1973, Miller and Murphy 1976).

Fig. 7.1: The resected triangular flap, capsular plication procedure

Fig. 7.2: The wound of the TMJ capsule after resection one of the triangular flap

Fig. 7.3: Radiographic appearance of the anterior translation of the left condyle after capsular plication procedure

Fig. 7.4: Picture shows the expose articular eminence following surgical dissection

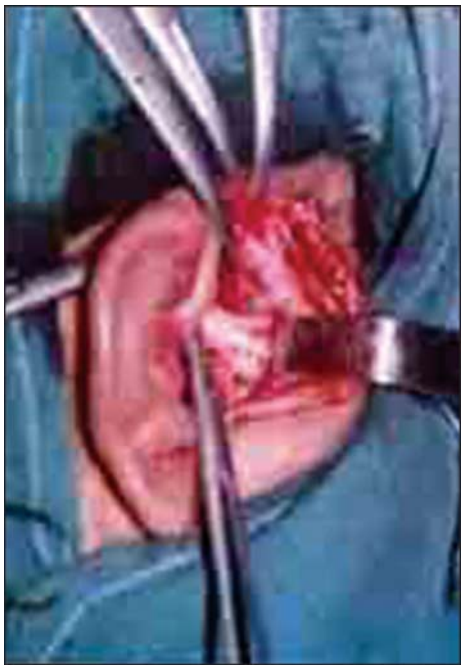


Fig. 7.6: Picture shows the bur holes drilled in the articular eminence

Fig. 7.5: The radiographic appearance shows the anterior translation of the left condyle after articular eminectomy

Fig. 7.7: The radiographic appearance of the movement of the right condyle following articular eminectomy

3. *Plication of TM joint ligaments* (Hudson and Spire).
4. *Raising the hight of the articular eminence* by down fracture of the zygomatic bone (Dautrey 1975, Lawlor 1982).
5. *Eminectomy and meniscectomy* (Myrhaug 1951) allow to condyle to move freely. According to William Irby (80), the Norwaian surgeon Myrhaug operation still popular, simple and highly successful. Wanderkwast Scandinavian Authority recommended this technique still today.

Injury to the TM Joint Causes Complications as Follows

Arthrosis

Non-inflammatory conditions characterized by clicking or locking joint due to damage of the articular disc and capsule. The suggested cause are a traumatogenic occlusion with cuspal interference on closing; over-closure of the vertical dimension of the bite due to extraction of the posterior teeth or recession

Fig. 7.8: The picture shows the eminence is being separated by a flat chisel

Fig. 7.9: The picture shows the smoothening of the bone in the resected articular eminence area with vulcanite bur

of the alveolar ridges in denture wearers; and bad habits such as grinding the teeth or abnormal chewing on one side only.

Diagnosis: The chief symptoms are cracking or grating in the joint during movement and pain often referred to the temporal, cervical and occipital regions. It is usually worse on chewing or when the patient is tired. The affected condyle is tender to palpation, has restricted movement and an abnormal pathway on opening or closing. Radiographs show no obvious changes except possibly restriction of movement on opening. Electromyography has been used recently as a diagnostic aid but interpretation of the results is still inconclusive.

Conservative treatment

1. Rest.
2. Rehabilitation of the occlusion.
3. External heat.
4. Short-wave diathermy.
5. NSAID.
6. Operative treatment.
7. Arthroscopy.
8. Meniscectomy.

Arthritis

Inflammation of the TM joint: Osteoarthritis or traumatic arthritis may result from damage to the articular surface of the joint. X-ray shows sometimes condylar lipping and the narrowing of the joint space. It is affected in older age group. The TM joint suffers destruction of the cartilage on the condyle and the meniscus, with resorption of the bone of the condyle head, articular fossa and the articular eminence.

Rheumatic Arthritis

Commonly affected middle age females about 35 to 40 years old. Polyarthritis of the joint swollen and painful joint with rise of temperature and ESR atrophic skin generalized lymph adenopathy.

Treatment: Salicylates and steroid as palliative measures.

Diagnosis: The symptoms are stiffness and crepitus, accompanied by occasional pain. Radiographs show eburnation and flattening of the condyle head and the artiular eminence with occasional loose bodies in the joint.

Conservative treatment includes:

1. Physiotherapy.
2. Short-wave diathermy.
3. Antibiotic, anti-inflammatory and analgesic.
4. Operative treatment.
5. Arthoplasty by arthroscopy technique.

TMJDS/MPDS/Facial Arthomyalgia

FAM, facial arthomyalgia (Harris) is the latest terminology of TM joint pain dysfunction syndrome

(Schwartz), myo-facial pain dysfunction syndrome which was also called in past as "Costen" syndrome.

The principal causes of TMJPDS/MPDS/FAM are emotional, anxiety distress perspective rather than physical cause (Laskin and Harris).

According to Bell, the FAM/TMJPDS is initially a problem of the masticatory muscles rather than arthropathy.

Pain mechanism probable release of P P substance due to intermuscular vasodilatation of the facial muscles.

Laskin described the typical clinical panaroma of TMJPDS explain as four cardinal signs and two negative components.

Cardinal Signs

1. Unilateral joint pain.
2. Muscle tenderness.
3. A clicking and popping noise in the TM joint.
4. Limitation and/or deviation of mandibular movement.

Diagnosis

The symptoms are pain, muscle tenderness clicking and locking or popping noise of the joint. Clicking is due to the condyle riding over the meniscus and coming sharply into contact with the bone of the articular fossa. It occurs late on opening if the meniscus is detached anteriorly, and late on closing if it is detached posteriorly. Locking is due to the detached or torn meniscus jamming the smooth action of the condyle.

There must be two negative components:

1. No radiographic changes in the TM joint.
2. No tenderness of the TM joint when palpated through external ear canal.

Hamish Thompson, 87 outline the syndrome and clinical described by the patient attended the clinic from 54 to 83 of TMJPDS as follows:

1. Pain in the preauricular region during and following mastication usually in one side only. The pain was sometimes referred to the frontal, parietal, and occipital neck region.
2. Tenderness over ear in front of the mandibular joint.
3. Limitation of opening.
4. A clicking noise within or other joints.
5. Spasm of the closing muscles on waking with consequent clenching of the teeth.

Clinical Features

1. Cusp interference were noted on closure from rest position on retruded closure, on lateral excursions in empty mouth and during unilateral chewing.
2. Missing or displaced teeth, which suggested the like-hood of unilateral chewing and cause of cuspal interference.
3. Facets on the teeth indicating a para-functional grinding habit were common.
4. Clicking noise during jaw movements was often the chief complaint.
5. Deviation of the mandible to the affected side.
6. Confirmed the diagnosis of a tissue disorder.

Treatment Procedure

Counselling: This consists of explaining the condition in simple lucid manner by understandable lay term with "reassurance" that recovery is likely if the advise is follows.

Toller study (74) shows, simple reassurance and explanation—produced improvement 80 percent at 3 months with anxiolytic and muscle relaxant action like benzodiazepines. Diazepam 2 mg and 5 mg three times a day for 2 to 3 weeks.

Occlusal splints: Full occlusal coverage maxillary splint to give higher, positive response (Greene and Laskin '72).

1. The possible mechanism of beneficial effects of splint reduces the muscular overactivity explained by Jarabak 56, Solberg 75, Clerk et al 79 by their EMG studies.
2. Splints render the premature occlusal contacts.
3. Opening of the bite prevents terminal closure and may reduce stimulation of post, part of the joint capsule (Posterior auricular nerve).

Physical therapy

a. In the form of moist heat (Hydrocollator neck type) 30 min/day both joints.
b. Short-wave diathermy.
c. Interferential therapy (Recent addition of Physiotherapy) (Ultrasound 3 MHz head is used).

Therapeutic exercises

a. Straight opening exercise.
b. Suprahyoid exercise.
c. Finger and thumb dilation exercise.

4. *Use of intra-articular injection of corticosteroid:* Excessive hypermobility and tendency to subluxation of TM Joint associated with recurrent pain dysfunction syndrome treated successfully after the acute phase is over by sclerosant therapy.

   Paul Bradley recommended the use of one ml STD (3% Sodium tetradecyl sulphate) to inject into the lateral aspect of joint capsule. A single injection is sufficient to reduce the interincisal clearance by about 2 to 3 mm.
5. Harris recommended the use of arthrocentesis (that is lavage or irrigation of the upper joint cavity, which improve the elimination of joint inflammation, and subsequent relives pain, and return to normal function (by arthroscopy procedures). The condylar shave, the removal of fibrous tissue affecting the joint by previous method.

   Arthroscopy was performed with the patient under general anesthesia via nasoendotracheal intubation and neuromuscular relaxation. Dexamethasone 0.5 mg per kg body weight and suitable antibiotic were given parenterally. Normal saline was used for irrigation and distention. Double or triple superior posterolateral and anterolateral puntcher technique as described by Moses '89 was used. A systemic arthroscopic examination of the superior joint compartment was performed. After the examination arthroscopic surgery was proceed. Depending on the finding during inspection, the following procedures were carried out using triangulation technique as per Macain '89, which may have the following stages or phases.
   a. Capsular release, lysis or resection of adhesions.
   b. Coagulation or hypervascular tissues and retrodiscal tissues, and mobilization of the disc.
   c. Physiotherapy started on the first day of postoperatively.
6. *Denervation procedures:* Thilander demonstrated well, the rich enervation of the posterior aspect of the capsule by the posterior auricular nerves arising from the auricular temporal nerve. She has also shown there is also a nerve supply from the nerve to the massetor and frequently post-deep temporal nerves. Poswillo '75 described injecting small volume of STD sclerosant close apposition to the posterior attachment of the TM Joint capsule to achieve neurolytic action.

   Bradely '87 suggested a simple conservative surgical approach to the post aspect of the joint capsule for selective sectioning the post-auricular nerve.
7. A new form of conservative therapy is TM joint arthroscopy (Sanders 86, Murakami 86, Harris 88).
8. *Laser under arthroscopy control:* A quartz fibre probe is indicated when a laser is used under an arthroscopy. Burning, evaporation and coagulation all occur, while the physiologic saline solution is perfused for cooling the surgery region. The Nd-YAG laser is the most suitable for this technique, since it can pass through fibres. They mostly uses laser fibres of 1.5 mm outer diameter at 10 – 20 W for surgery of the joints. Tissues can be burned, evaporated and coagulated on mere contact—no mechanical force is required. As no bleeding is involved, and since visual fields are secured, the laser technique is the most suitable for arthroscopic surgery.
9. As Harris '84 believed that the pain mechanism is FAM is released of P substance due to vasodilatation of the facial muscles by tension, anxiety and depression (P substance hypothetical factor described by Lewis's the substance which produce by ischemic muscles causes pain).

The use of anxiolytic tricycle antidepressants such as nortriptyline and motival is of great value of treating these cases. Here, the use of medication for its centrally-acting muscle relaxant and analgesics effect, not as an antidepressant.

Rowe's Proposed the Limited Mandibular Mobility into the following Categories

1. Trismus (muscle spasm).
2. Pseudoankylosis (mechanical interference)
3. False ankylosis (extracapsular in origin).
4. True ankylosis (intracapsular in origin).

Trismus

Definition

The word *'Trismus'* is derived from Greek word *"Trismos"* meaning gnashing or lockjaw.

Upto seventeenth century it was used almost exclusively when referring to tetenus. In the year of 1718, the famous German Surgeon 'Lorenz Heister' gives the first scientific entity of 'Trismus' describing a case. *'Trismus'* term is boldly used for inability to open the mouth. But in the year of 1963, IJ Berlove of UK defines

Trismus, "A condition of spasm of the jaw muscles causing them to the rigid, and preventing the opening of mouth either partially or totally, temporarily or permanently".

In 1973, Nally and Eggleston define trismus simply and lucidly, "inability to open the mouth due to reflex muscle spasm".

But, probably best in all aspect trismus is defined by Sir Norman L, Rowe in his famous William Guy lecture in 1981.

Trismus is mediated by the "Servo feed back" of arthokinetic reflex arc from proprioceptive nerve endings in the periodontium, the muscle spindles and the mechanoreceptors of the joint capsule via the brain steam to the muscles, which activate the closure of the lower jaw.

Once the existing stimulus is removed, the condition disappears.

Ankylosis can be defined as stiffness or immobility of the joint due to fibrous adhesion or bony fusion within the joint or between two bones.

**Modified Rowe's Classification of Trismus*

1. Odontogenic – MPDS (myofacial pain dysfunction syndrome), malocclusion, erupting teeth.
2. Infection – Periodontitis, pericocoronitis, submasseteric, temporal, peritonsiller space infection, parotitis.
3. Traumatic – Fracture of the mandible, fracture of the zygoma impinging the coronoid.
4. Neoplastic – Tumors involving the jaw muscles, retromolar fossa, tonsillar fossa, nasopharynx (Trotter's syndrome).
5. Pharmacological – Some phenothiazines.
6. Psychological – Hysterical trismus (Thoma, Kurt H)
7. Neurotoxic – Tetanus.
8. Neurological – Central and peripheral lesion.

Rowe's classified OSMF, myositis ossificans in separate heading designated as pseudoankylosis (will be discussed later).

Some analytical observation on clinical perspective:

1. Treatment of trismus is primarily based on aetiological factors, clinical panaroma, and degree of myospsam.
2. The antibiotics are most effective in trismus of odontogenic infection involving muscles of mastication directly, or via facial planes.
3. Surgical interference is mandatory according to necessity (Removal of offending tooth or teeth, drainage of abscess).
4. Infraray therapy helps in localization abscess in earlier stage and in relieving spastic condition of muscle due to inflammatory process.
5. Muscle relaxant property of diazepam is widely used in practice.
6. Use of Brisment force. Mechanical appliance (Fergusion's mouth gag, acrylic screw) is found to be helpful in relieving trismus in post-extraction cases.
7. Trismus is not always associated with pain.
8. Trismus is a reversible condition mostly and irreversible partly.

Etiology of Pseudoankylosis

Trauma	Depressed fracture of zygomatic bone or arch (mechanical obstruction of coronoid process)
Hyperplasia	True developmental hyperplasia of coronoid process. Relative hyperplasia due to short ramus in acquired deformity of the condyle
Neoplasia	Chondroma/osteoma/osteosarcoma of coronoid process
Miscellaneous	Myositis ossificans Congenital anomalies (very rare) Submucous fibrosis

Etiology of Extracapsular Ankylosis

Trauma	Periarticular fibrosis (wounds or burns) posterior or superior dislocation (rare). Chronic dislocation of long duration
Infection	Chronic periarticular suppuration (pyogenic/mycotic/tuberculous)
Neoplasia	Fibrosarcoma of capsule (rare) Chondroma from ectopic tissue (rare)
Radiation	Periarticular fibrosis/osteoradionecrosis. Inhibition of condylar cellular activity (child)

Etiology of Intracapsular Ankylosis

Trauma	Intracapsular comminuted fracture.* Penetrating wounds (gunshot and/or infected) Forceps delivery
Infection	Otitis media/mastoiditis Osteomyelitis of the jaws Haematogenous
Systemic-arthropathy	Still's disease (juvenile osteoarthritis) Ankylosing spondylitis (Marie-Strumpel disease) Osteoarthritis Rheumatoid arthritis
Neoplasia	Chondroma/osteochondroma/steoma Sarcoma/fibrosarcoma (rare) Metastasis to condyle
Miscellaneous	Chondromatosis ("melon-seed") loose bodies

* Particularly when bilateral, under the age of five years, or associated with prolonged unconsciousness.

Universally-accepted Dictum or Protocols for the Management of TM Joint Ankylosis Recommended by Kaban, Perrot and Fisher 90

1. Should obtain the easy visual access and sufficient exposure for early surgical intervention.
2. Resection must be sufficient, achieve a gap of at least 1 to 1.5 cm.
3. Ipsilateral coronoidectomy and temporalis myotomy recommended.
4. If incisal opening is <35 mm then contralateral coronoidectomy is sometimes necessary.
5. The rigid fixation of graft with the ramus is required for early mobilization and active physiotherapy to be started after 2 weeks of IMF to prevent soft tissue contractors.
6. Lining of the glenoid fossa region with temporalis fascia.
7. The reconstruction of the ramous preferably with a constochondral graft.
8. Regular long-term follow up.
9. When the growth of the condyle of the patient is completed at the later stage a cosmetic surgery may be needed for symmetry.

Aims and Objectives of Surgery as Summarized by Rowe

1. Removal of ankylosed mass and creation of a gap mobilized the joint.
2. To achieve a functional joint.
3. To reconstruct the joint and restored the vertical height of the ramus.
4. To improve patient's nutrition and oral hygiene.
5. To restore normal facial growth pattern (which is based on the functional matrix theory). An analytical notes. The functional matrix theory concept of Melvin moss on growth and development explain the doctrine of functional matrix complementary to the original version of functional component of Vander Klaaus. The functional matrix concept attempts to comprehend the relationship between form and function. The functional matrix hypothesis claims that the origin, form, position, growth and maintenance of all skeletal tissues and organs are always secondary, compensatory and necessary responses to chronologically and morphologically prior even or process that occur in specifically-related non-skeletal tissues, organs or functioning spaces. Moss's claims that the growth of the skeletal components, whether endochondral or intra-membranous in origin is largely dependent on the growth of functional matrices.
6. To improve cosmetics and rehabilitation of the patient.
7. To prevent recurrence.

Surgical Modalities

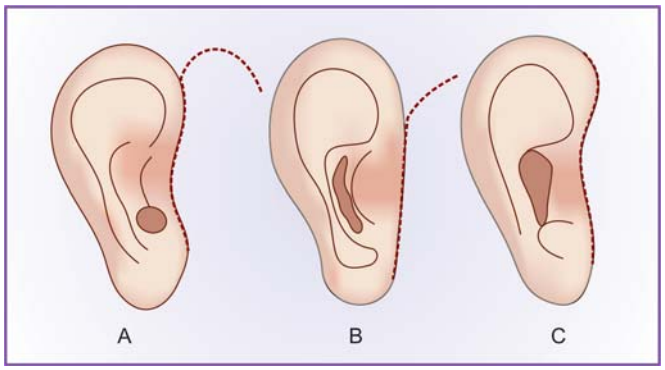
Various authorities of TM joints surgery have advocated various methods recommended and described from time to time. Ultimately the following surgical techniques mostly adopted.

1. Condylectomy. Originally described by Henny, excision of the condyle in case of fibrous ankylosis, where articular space is still persisting, along with removal of fibrous bands which restricted the movements.
2. Gaparthroplasty is the operative technique described as to bony cuts by two horizontal osteotomy and removal of a bony wedge to achieve a gap between the glenoid fossa and the ramous of the mandible. The gap should be at least 1 cm to prevent reankylosis. Gaparthoplasty sometimes performed with coronoid ectomy that means the removal of the coronoid process.
3. Interpositional arthroplasty with costochondral graft (interpositional arthroplasty according to Topazin Brothers involves the creation of a gap and placement of a barrier which may be outogenous

or alloplastic materials inserted between the cut bony surfaces to prevent recurrence and to maintain the vertical height of ramus).

The most of the surgical procedure exposure of TM joint area the following incisions recommended for operative technique.

1. Blair used an incision resembling and inverted L, commencing of the temporal airline and curving downwards in close proximity to the anterior auricle (Fig. 7.10).
2. Dingman and Moorman recommended an incision the sectioning the minor fibrous attachment of the lamina of tragus and superior aspect and reflecting this cartilage anteriorly and down over itself (Fig. 7.10).
3. The Blair incision slightly modified by Rowe's slightly extending the superior limb of inverted L. This incision also resembling the original preauricular incision of Thoma (Figs 7.10 and 7.11).



Figs 7.10A to C: The variation of preauricular incisions. (A) Blair's inverted hockey-stick incision. (B) Rowe's extended Blair's incision or Thoma's angulated incision. (C) Dingman's and Moorman's incision

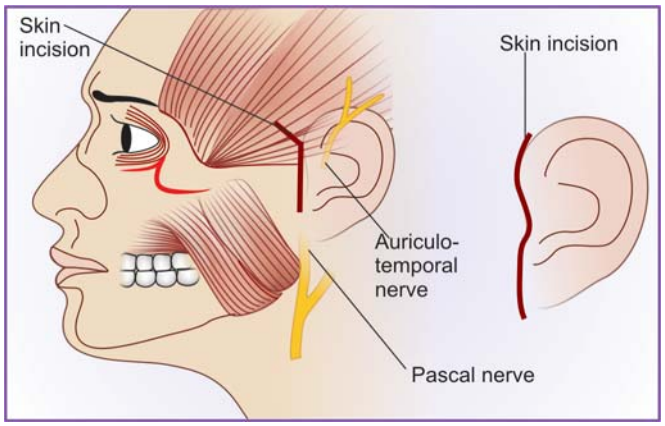


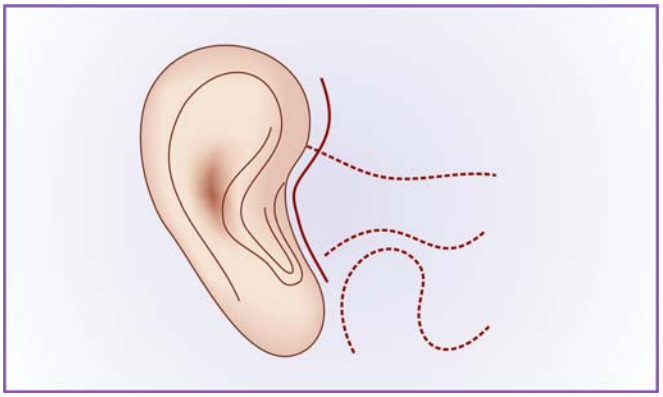
Fig. 7.11: Blair incision modified by Rowe's. Dingman's incision

4. Preauricular incision the basic incision for TM Joint ankylosis (Fig. 7.12).
5. The Egyptian oral maxillofacial surgeon Adil-Alkyat 79 and English oral maxillofacial surgeon Paul Bramely recommended a question mark incision for maximum visual and mechanical access (Fig. 7.13).
6. (A) Sub-mandibular or Risdon's approach and (B) postramal or hind approach (Fig. 7.14).
7. Popowich and Crane modification of Adil-Alkyat and Paul Bramely's question mark incision 82 (Fig. 7.15).

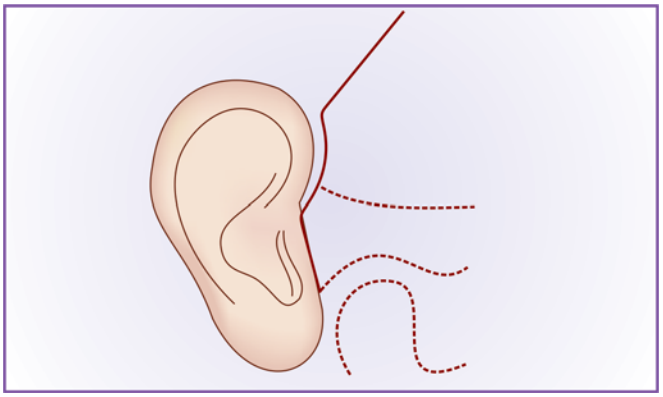
The approach claims the extension of the incision slightly less than the previous question mark incision.

The dissection can be achieved through the avascular area and reduction of total operating time, and postoperative edema and discomfort and good cosmetic results.

In early 80s Prof Janardhanan and Prof. Sunderrajan in India, first performed costochondral



A



B

Figs 7.12A and B: (A) Preauricular incision, (B) Modified preauricular incision

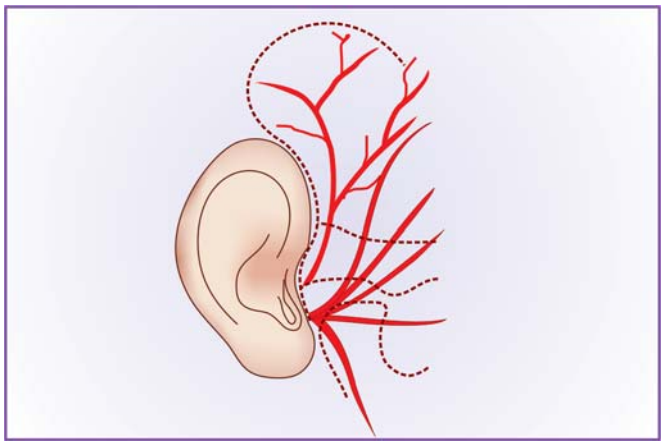
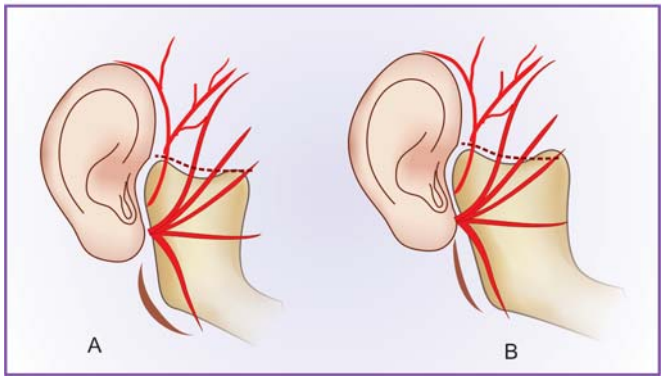
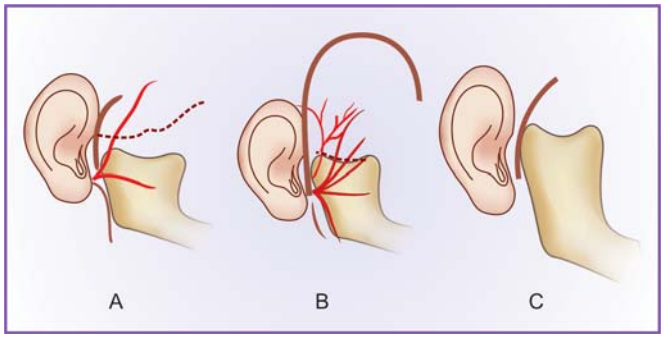


Fig. 7.13: Question mark incision



Figs 7.14A and B: (A) The incision is given about 1cm below angle of the mandible. It extends forward parallel to the lower border and curves backward slightly behind the angle of the mandible. This approach provides the poor access to the condylar head region. (B) Excellent cosmetic procedure recommended by Hind, for surgeries involving the condylar neck and ramus area



Figs 7.15A to C: (A) Preauricular incision the basic and usual approach of TM joint originally described by Blair. (B) It is a modified Adil-Alkyat and Paul Bramely's incision recommended by Popowich and Crane. The incision slightly larger than the former incision. This incision provides excellent visual and mechanical access. (C) It is a Rowe's modified preauricular approach explained as reverse extended 'L' incision

graft surgery by Adil-Alkyat and Paul Bramely's approach in ankylosis of TM joint.

For better adaptation of chondral graft as growth centre of condyle to the ramus of the mandible via Risdon approach, they improvized a technique the mortise of outer cortex of the ramus as well as inner aspect of the chondral graft for better result (the mortise means the roughing of the inner aspect of the chondral graft and the outer cortex of the ramus by vulcanite bur).

The costochondral graft act as initiator of condylar growth centre. Janardhanan has also shown in animal experimental study (dog) a chondral graft placed in the dog mandible, after the mortise the graft and the mandible.

After sometimes the mandible of the dog removed and series of section showing on H.P. examination the encouraging adaptation of the graft. Prof Phillip J Boyne also supported this method.

An appraisal of TM joint ankylosis over 15 years review of management by Prof Harris as follows :

The condylar growth centre contributes approximately 20 per cent of ascending ramus height and width, and its loss does not affect mandibular body growth if function is restored before puberty. Therefore, a simple gap or interpositional arthroplasty, even in the first decade, will give minimal asymmetry at rest and on opening in adult life with good adjustment or the occlusion. Asymmetry can be avoided by grafting a costochondral growth centre before puberty, but may produce an ipsilateral hyperplasia if the costal cartilage growth exceeds the ramus requirement.

Prolonged ankylosis extending through puberty will impair total mandibular growth leading to micro and retrognathia. This requires both excision of the ankylosis and reconstruction of ramus height, which may be achieved with a variety of techniques.

Ankylosis occurring in adult life after the completion of growth with no loss of ramus height, merely requires the separation of the fused bony parts. This can be done with a silicone elastomer (Silastic) membrane.

Relapse may be Attributable to Three Factors

1. Inadequate removal of bone at the site of the ankylosis.

2. Failure to recognize postankylosis contracture formation in both temporalis tendons requiring bilateral coronoidectomy or myotomy.
3. Failure to recognize that exuberant bony fusion especially in the adult, is probably a manifestation of fibrodysplasia ossificans, which can be prevented by diphosphonate therapy, e.g. disodium etidronate (Didrobnel) 700 mg a day for three months or 350 mg a day for six months.

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EIGHT

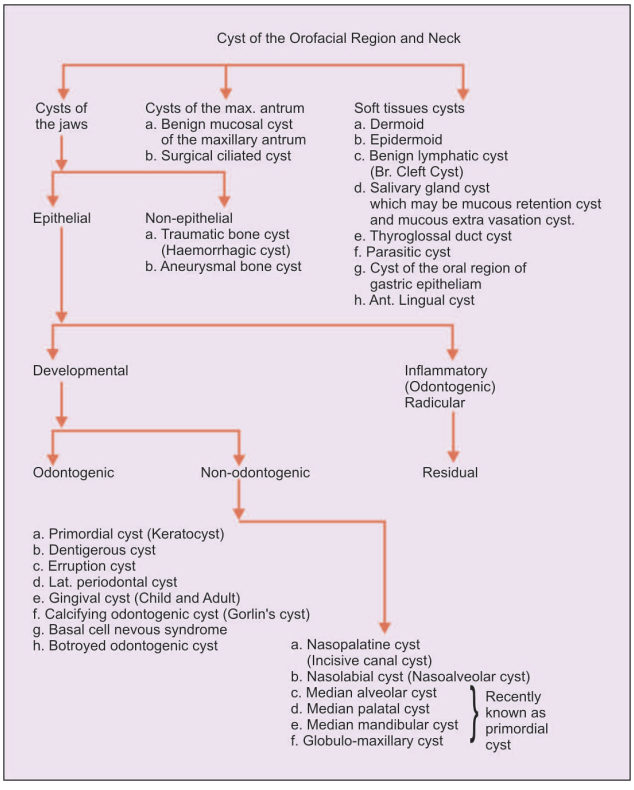
Odontogenic and Non-odontogenic Cysts of Jaws

• Definition of Cyst • Classification • Concept and Etiopathogenesis of its Growth and Development • Detail Discussion of Dentigerous Cyst • Odontogenic Keratocyst (Primordial) • Periapical Radicular Cyst • Certain Analytical Observations of Odontogenic Keratocyst • Various Treatment Modalities of Management of Cysts

DEFINITION OF CYST

Cyst is an abnormal cavity having fluid, semi fluid or gaseous contents which is not created by the accumulation of pus (*Modified Kramer, Ivor RH). It is frequently but not always, lined by epithelium, *and expanded by the process of osmosis.

Modified Classification Recommended by Shear and Kramer



Simple Classification Recommended by Harris and Seward

A. *Of odontogenic epithelium*:
1. Derived from the dental lamina:
   a. Keratocysts:
      i. Solitary or primordial cysts
      ii. Pseudofollicular or extrafollicular dentigerous cysts.
   b. Calcifying odontogenic cysts (Gorlin's cyst).
2. Derived from reduced enamel epithelium:
   a. Eruption cyst.
   b. Follicular or dentigerous cysts:
      i. Periocoronal
      ii. Lateral
      iii. Residual.
3. Derived from epithelial debris of Malassez:
   a. Inflammatory periodontal (radicular):
      i. Apical
      ii. Lateral
      iii. Residual.

B. *Of non-odontogenic epithelium (Fissural)*:
   1. Nasopalatine
   2. Nasolabial.

C. *Bone cysts*:
   1. Solitary bone cyst.
   2. Aneurysmal bone cyst.

} Cyst without epithelial lining or pseudocysts by Cawson.

Classification of Odontogenic Cyst Recommended by Charles A Waldron from Neville et al

Developmental

1. Dentigerous cyst.
2. Eruption cyst (Eruption hematoma).

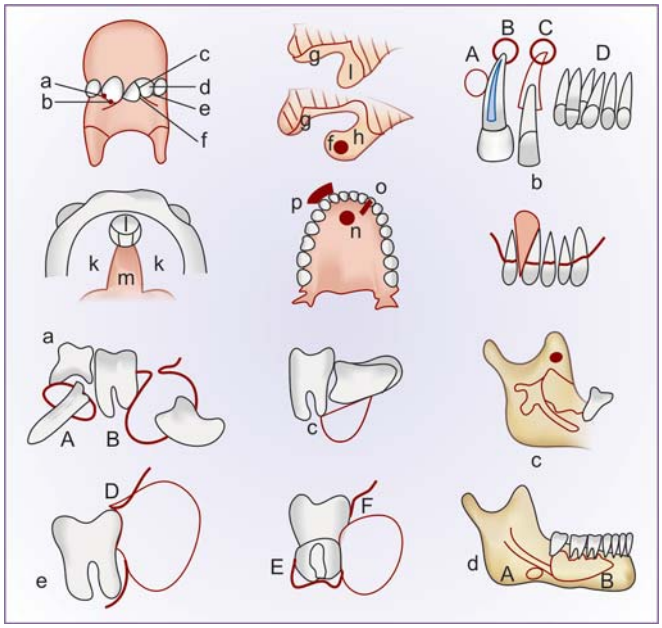


Fig. 8.1: Cysts of the jaws

A, Fissural cysts: Top left, Diagram of the face of a human embryo at 6 weeks. Top right, Diagram of sections through the developing nasal pit showing how the nasal fin is breached by maxillary and pre-maxillary mesoderm. a, Site at which nasolabial cyst develops. b, Site at which globule maxillary cyst develops. c, Nasal pit. d, Lateral nasal process. e, Naso-optic or nasomaxillary groove. f, Nasal fin. g, Olfactory placode. h, Bucconasal membrane. Bottom left. Diagram of the developing palate. Bottom right. Sites of fissural or non-odontogenic developmental cysts. j, Primary palate or medial palatal process. k, Lateral palatine process. m, Site of nasopalatine (incisive canal) cyst. n, Incisive canal cyst. o, Globulomaxillary cyst. p, Nasolabial cyst. b, Periodontal cyst: A, Lateral, B, Apical, C, Residual, D, Residual (deciduous tooth). c, Primordial cysts: Top: Replacing tooth. Bottom. Distal to 3rd molar. d, Bone cyst: A, Stafne's idiopathic cavity. B, Solitary bone cyst. e, Dentigerous and developmental periodontal cysts: Dentigerous cyst – A, circumferential; B, pericoronal; C and D, Lateral. Periodontal cysts – E, Lateral; F, Distal–Cited from Harris and Seward

3. Odontogenic keratocyst.
4. Orthokeratinized odontogenic cyst.
5. Gingival (alveolar) cyst of the newborn.
6. Gingival cyst of the adult.
7. Lateral periodontal cyst.
8. Calcifying odontogenic cyst (Gorlin's cyst).
9. Glandular odontogenic cyst.

Inflammatory

1. Periapical (radicular) cyst.
2. Residual periapical (radicular) cyst.
3. Buccal bifurcation cyst.

An Analytical Observation

1. Cawson considered the cystic ameloblastoma and calcifying epithelial odontogenic cyst (Gorlin cyst) as neoplastic cysts.
2. The terms odontogenic keratocyst and primordial cyst were used synonymously. In 1972, WHO classification used the designation primordial cyst as the preferred term for this lesion. In 1992, WHO classification, however, lists odontogenic keratocyst as the preferred designation.
3. Orthokeratinized odontogenic cyst is not a specific type of odontogenic cyst but more of histological concept.
4. Gingival cyst of the new born are also called as Epstein's pearls and Bohn's nodules. This cyst is derived from remnants of the dental lamina, and commonly seen in newborn babies. However, they disappear spontaneously by rupture into the oral cavity.
5. Gingival cyst of the adult is an uncommon lesion. It is considered to represent the soft tissue counterpart of the lateral periodontal cyst and the other name is Botryoid odontogenic cyst.
6. Glandular odontogenic cyst (Sialo-odontogenic cyst) is a rare and recently recognized type of developmental odontogenic cyst that can show aggressive behaviour. They clinically occur commonly in middle-aged adults in the anterior region of the jaws. The size of the cyst may vary from 1 cm to large destructive lesions involving most of the jaws, the small lesion may be asymptomatic, but a large cyst often produces clinical expansion associated with pain or paraesthesia. X-ray appears as an unilocular or multilocular radiolucency.

   Treatment includes enucleation or curettage. Some authors recommended en block resection for the potential aggressive nature of the cyst.
7. The buccal bifurcation cyst an uncommon inflammatory odontogenic cyst commonly develops on the buccal aspect of the mandibular first permanent molar. The pathogenesis of this cyst is uncertain. This may be an inflammatory response, which may occur in the surrounding follicular tissues that stimulates cyst formation during the eruption of the tooth. Radiologically shows a well-circumscribed unilocolur radio-lucency involving the buccal furcation and root area of the involved tooth.

Treatment includes enucleation. The extraction of the associated tooth is not necessary.

8. Kaneschiro and associates described a post-operative maxillary cyst in Japan (Cited from Peterson). This is due to delayed complication of radical surgical intervention in the maxillary sinus and documented histololgically.

Growth and Development of Odontogenic Cyst

The most popular concept of odontogenic cyst growth was delivered by Prof. Malcolm Harris in his Hunterian lecture in March 1974, the theories listed as follows, lesion expands in a balloon-like manner resorbing the surrounding bone, the expansile force being created by an accumulation of intracystic contents which may be listed as follows:

1. Cyst epithelium and its products of autolysis.
2. Plasma proteins derived from transudation, exudation, and intracystic haemorrhage.
3. Tissue fluid drawn into the cyst owing to the high osmolality created by (a) and (b).
4. Mucus secreted by the goblet cells, which are found in some follicular, and nasopalatine cyst wall (Main, Toller and Browne).

Harris in his research has shown the bone resorbing prostaglandins (PGs) responsible for cystic bone resorption. He also mentions the varieties of prostaglandins (PGEs and PGFs as well as PGE2) in different cystic types for prostaglandins-induced bone resorption.

Harris also quoted the term name 'Osteoclast-activating factor' (OAF) by Horton et al. Bone resorbing is activated by a variety of humeral agents (Raisz'70) which includes parathyroid hormone, vitamin D, prostaglandins lymphokine produced by stimulated B lymphocytes which has been named osteoclast-activating factor (Harris).

Cawson Summarized the Pathogenesis of Cyst Formation as Follows

1. Proliferation of epithelial lining and fibrous capsule.
2. Hydrostatic pressure effect of cystic fluid around the surroundings.
3. Resorption of the surrounding bone.

Concept of Mode of Formation of Various Types of Developmental Odontogenic Cysts Cited from Lucas

1. Cyst formation takes place in the enamel organ at an early stage, before the deposition of enamel. A primodial cyst results.
2. Cyst formation takes place or occurs in the enamel organ after the tooth has formed. A dentigerous cyst results.
3. A dentigerous cyst may in some case result from cystic changes in remnants of the dental lamina with subsequent development of the crown of the tooth in the cyst.
4. Cyst formation in the lateral part of the enamel organ produces a lateral dentigerous cyst.
5. A laterally situated cyst may also arise from cyst formation in epithelial rests.
6. Multiloculated cyst arising from cystification in buds forming from the enamel organ (Thoma and Goldman).

Primordial Cyst (Keratocyst)

Philipson named the term 'odontogenic keratocysts' in the year 1956 and it is now quietly accepted. Subsequently supported by Pindborg, Philipson and Henriksen in 1962, Pindborg and Hansen in 1963 designated that keratocyst mean a cyst that contain keratin by a large extent. The several misleading implications lead to controversy regarding the name. Considering the distinct entity of developmental origin, arising from primodiam odonotogenic epithelium. Mervyn Shear prefers the term primordial cyst to the nonspecific histological term keratocyst.

Clinical Features

1. Age: Common in second and third decades of life.
2. Sex: It is frequently seen in males than females.
3. Site: The mandible is more frequently involved than the maxilla.
4. Patient complains of swelling, discharge, or may be pain. Some of the patients may develop a pathological fracture, because of being unaware of the lesion. Some instance patient free from symptoms until the cysts have reached to a large size involving entired ramus. This is because the expansion of primordial cyst into the medullary

cavity early and bony expansion occurs late. The cyst also produces the displacement of the teeth.

Concepts of Recurrences

There are several concepts of frequent recurrence of primordical cysts as follows:

1. Occurrence of satellite cysts, which are, retained during an enucleation procedure. There may be formation of new cysts rather than recurrences.
2. The cystic linings are very thin and fragile, and therefore difficult to enucleate, and part of the lining may be left behind, and constitute the origin of recurrences (Kramer Ivor R. H. 63 Fickling B. W. 65).
3. Toller in 1967 suggested that epithelial lining of cysts have an intrinsic growth potential and regards a primordial cysts as being a neoplasm.
4. Soskolen and Shear in 1967 suggested that patients with naevoid basal cell carcinoma syndrome having predisposition to form primordial cysts from the dental lamina.
5. Stolelinga 1971 and Stolilinga Peters in 1973 proposed that the primordial cysts may arise from proliferations of the basal cells of the oral mucosa particularly in the third molar region and ascending ramus of the mandible. They also mentioned the adhesion of the cysts to the overlying mucosa and should be excised to prevent possible recurrence from the residual basal cell proliferation.

Radiological Features (Figs 8.2 and 8.3)

Primordial cysts may appear in X-rays as small round or ovoid radiolucent areas with well-demarcated distinct sclerotic margins in case of slow enlarging lesion. Majority of unilocular radioluscencies having a smooth periphery. This is common in case of maxillary lesions. Some of the unilocular lesions have scalloped margins, and these may be misinterpreted as multilocular lesions. There may be extensive involvement of the body and ascending ramus of the mandible, with little or no bony expansion.

Pathogenesis (Fig. 8.4)

The primordial cyst arises from odontogenic epithelium prior to tooth formation, that means the dental lamina or its remnants. It can be explained lucidly—the tooth bud instead of forming a tooth degenerating into a cyst (Main Soskolin and Shear 67 and 70).

A B

Figs 8.2A and B: X-ray appearance of primordial cyst (Keratocyst). (A) Mandible and (B) Maxilla

Fig. 8.3: X-ray appearance of primordial cyst (Keratocyst), mandible (left side)

Fig. 8.4: Histopathological appearance of primordial cyst (Keratocyst). Typical thin parakeratinized epithelium with well-defined basal cells

Investigation: Electorphoresis Study

a. Estimation of soluble protein from aspirated cystic fluid is a valuable aid in the preoperative diagnostic of primordial cysts. Toller's study in 1970 shows that if the protein level is <4 gram per 100 ml blood it indicated the diagnosis of primordial cysts. A value of over 5 grams per 100 ml of blood would suggest a radicular, dentigerous or fissural cyst or even ameloblastoma.
b. Kramer suggested technique for preoperative diagnosis of primordial cysts by demonstrating keratinized squames of aspirating cystic stained film, subsequent studies of Kramer and Toller in 1973 reported the combined use of exfoliative cytology and protein estimation in the preoperative diagnosis of cysts. Smears are made by placing a drop of cystic fluid on a clean glass slide and spreading with the edge of a dry cover slip. Two smears of each specimen are allowed to air dry and are stained respectively with haematoxylin-eosin and by the Rhodamine B fluorescence method (Clausen and Dabelsteen, 69). A third is allowed to dry to a tacky state and fixed in a solution containing 75 percent ethyl alcohol and 3 percent acetic acid prior to staining with the Papanicolaou procedure.

Treatment

The methods of treatment recommended which includes as follows (by Attenbourgh, 74 and Voorsmit, 81)

1. Total enucleation and primary closer.
2. Enucleation with chemical fixation. Voorsmit recommended use of Cornoy's solution after enucleation from the bony bed to destroy the satellite cysts lining. The Cornoy's solution acts as chemo-cauterization to prevent recurrence. (Composition of Cornoy's solution recommended by Thoma Glacial acetic acid 1 cc, absolute alcohol 6 cc, spirit chloroform 3 cc and ferric chloride 1 grain). Liquid N_2 spray acts to destroy the remnance of cystic lining. (Cryosurgical effect by Paul Bramley). Intraluminal injection of Cornoy's solution prior to enucleation helps to removing the cyst lining smoothly.
3. Marsupialization (Partsch technique).
4. Marsupialization followed by enucleation (Waldron two stage technique).
5. Resection.
6. Radiotherapy (Cook 73 with little and questionable value).
7. Peripheral osteotomy.

Paul Bramley recommended multilocular lesions should be treated by marginal excision with overlying mucosa. Some recommended excision with immediate bone graft, as the choice of operation.

Dentigerous Cyst

Sir James Paget 1863 first coined the term dentigerous cyst. It is the most common of all follicular odontogenic cysts, comprising about 95 percent of these lesions and about 34 percent of all odontogenic cysts. It is slightly more common among males than females and usually occurs in the second or third decade of life. About 70 percent of the lesions occur in the mandible and 30 percent in the maxilla. Almost 62 percent occur in the molar area, 12 percent in the canine area, and 12 percent in the premolar area, with the remaining 14 percent occurring elsewhere in the jaws. The mandibular third molar and maxillary canines are the most frequently involved single teeth. The dentigerous cyst produces enlargement of the jaw, and in some instances, it is quite marked.

Pathogenesis and Growth (Fig. 8.5)

Dentigerous cyst may be of extrafollicular or intrafollicular origin. Shear's rejects the extrafollicular theory of origin of dentigerous cyst. Intrafollicular cyst may develop by accumulation of fluid either between the reduced enamel epithelium and enamel or within

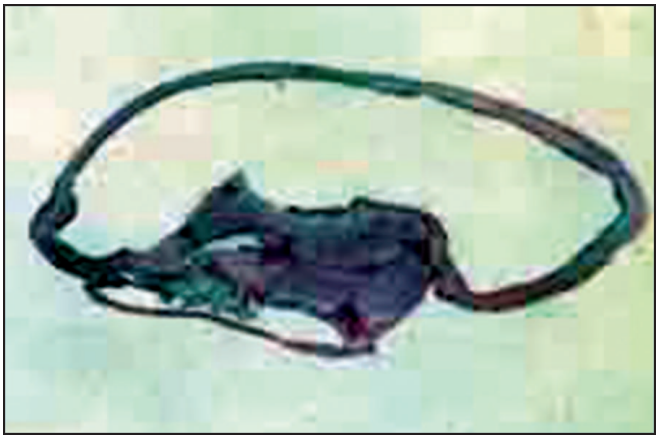


Fig. 8.5: Histopathological appearance of dentigerous cyst. A partly-formed tooth as seen in bottom part of the field

the enamel organ. The above mentioned views supported by Main 70 that pressure exerted by a potentially-erupting tooth on an impacted follicle, obstructs the venous out flow thereby induces rapid transudation of serum across the capillary walls. The increased hydrostatic pressure of this pulling fluid separates the follicle from the crown, with or without reduced enamel epithelium. Gradually, capillary permeability is altered to permit the passage of greater quantities of protein above the low concentration of the pure serum transuded.

Diagnosis and Investigation

On palpation of the area of enlargement presents the "typical eggshell crackling" due to expansion of the cyst thinning of the overlying bone. X-ray shows an unerupted tooth, a crown, which is surrounded by a clearly demarcated radiolucent area (Fig. 8.6). In a large cyst of the mandibular third molar area, the radiolucent zone may extend to the ramus. The teeth associated with the dentigerous cyst may be pushed out of place, i.e. to the lower border of the mandible or the floor of the nose in maxillary lesions. Dentigerous cysts have a greater tendency than other jaw cysts to produce the resorption of the roots of adjacent teeth (Struthers and Shear, 1976).

On aspiration the clear pale straw-coloured fluid is seen. On examination of the fluid cholesterol crystals are sometimes seen. Total protein > 4 gm per 100 ml on electrophoresis is of diagnostic importance.

Analytical Observation

Some authorities widely believe that ameloblastomas frequently arise in dentigerous cysts and are called mural ameloblastomas or some have been termed as preameloblastic lesion.

Dentigerous cyst may be of central, lateral and circumferential type. The eruption cyst in a child presents as a bluish fluctuant swelling in the mucosa immediately over an erupting tooth. This is also a variety of dentigerous cyst.

The eruption cyst (eruption hematoma) is the soft tissue cyst a variant of a dentigerous cyst. The cyst developing as a result of separation of the dental follicle from around the crown of an erupting tooth that is within soft tissues overlying the alveolar bone. The cyst appears as a soft translucent swelling in the gingival mucosa overlying the crown of an erupting primary or permanent tooth, mostly seen in children and in a younger age. The surface trauma may result in collection of blood in the cystic fluid showing a blue to purplish–brown colour. For this reason it is sometimes called as eruption hematoma. It does not require any treatment sometime a simple excision of the roof of the cyst permits speedy eruption of the tooth.

Treatment

1. Marsupialization (Partsh surgery in case of eruption cyst).
2. Enucleation with or without packing of defect (Waldron two stage technique).

Dental Cyst (Radicular Cyst, Periapical Cyst) (Fig. 8.7)

Dental cyst is usually asymptomatic. Most commonly seen in the anterior teeth in the maxilla rather than the mandible in the third decade of life.

Fig. 8.6: X-ray appearance of dentigerous cyst of the left mandible. The third molar is impacted and tilted

A B

Figs 8.7A and B: X-ray appearance of dental cysts/radicular cysts or/periapical cysts. (A) Maxillary central incisor and (B) Mandibular first premolar

There is a history of trauma, which leads to non-vitality of the tooth or a deep carious lesion or long-standing restoration. The patient may complain of pain, swelling discharging sinus, which reduces and suppresses after antibiotic and analgesic cover. The recurrent episodic attack is always present.

Mechanism of Formation of a Dental Cyst

Pulpitis, from which the tooth fails to recover, leads to inflammation and progresses to necrosis.

The trauma causes collection of blood in the apical region and the tooth becomes non-vital → Hematoma gets organized → formation of granulation tissue → fibrosis — as a result of inflammation the epithelium of periapical, area (epithelial rests of Malassez) proliferates and by continuous proliferation forms a large mass of cells. Since the epithelium has no blood vessels of its own, its blood supply must come from the surrounding connective tissue. Since the central cells in the epithelial mass are farthest away from the blood supply, they degenerate and form a small cavity, which is lined by epithelium. This is the beginning of the radicular cyst. Now the cystic cavity increases in size. The epithelial cells are shed into the cavity. Since cells consist of protein material, the intracystic osmotic pressure progressively becomes greater than that in the surrounding tissues. Tissue fluids and edema fluid are therefore gradually imbibed into the cavity. This, in turn, compresses the surrounding tissues and bone. The bone is resorbed, and the radiolucency becomes larger. In addition to this process, the granulation tissue of the cyst wall also continues to proliferate, destroying bone and thus enlarging the bone defect. Finally, the third mechanism in the growth of the radicular cysts consists of what may be called the "sequestration" of the connective tissue wall. The epithelial lining extends into the connective tissue of the cyst wall and incorporates parts of it into the cystic cavity.

X-ray: A radicular cyst is characterized by a more or less clearly demarcated radiolucency associated with the apical area of the affected tooth.

Treatment Method (Figs 8.8A to D)

1. Extraction of the offending tooth with apical curettage.
2. Apicectomy with R.C.T and obturation.
3. Enucleation.

Marsupialization or partsch operation (Fig. 8.9)

Residual Cyst

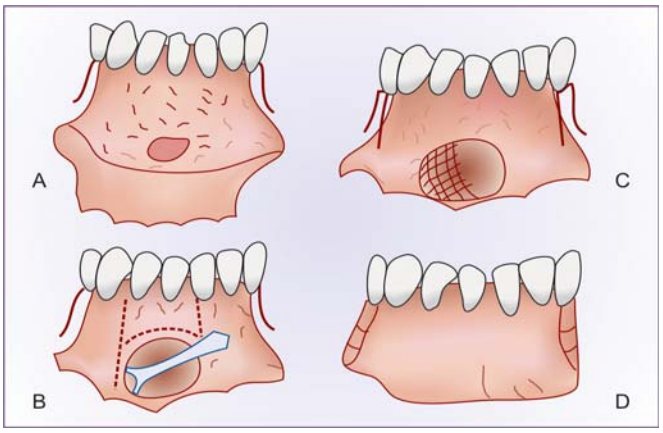
If a tooth is associated with a radicular cyst is extracted but the cyst is left undisturbed, it may persist within the jaw. Such a lesion is called a 'residual cyst.' Residual cysts represent about 3.5 percent of all periapical lesions. They occur in the maxilla more often than in the mandible and the majority of patients are in the fourth decade of life. Only by X-ray and history the presence of a residual cyst is detected.

Treatment

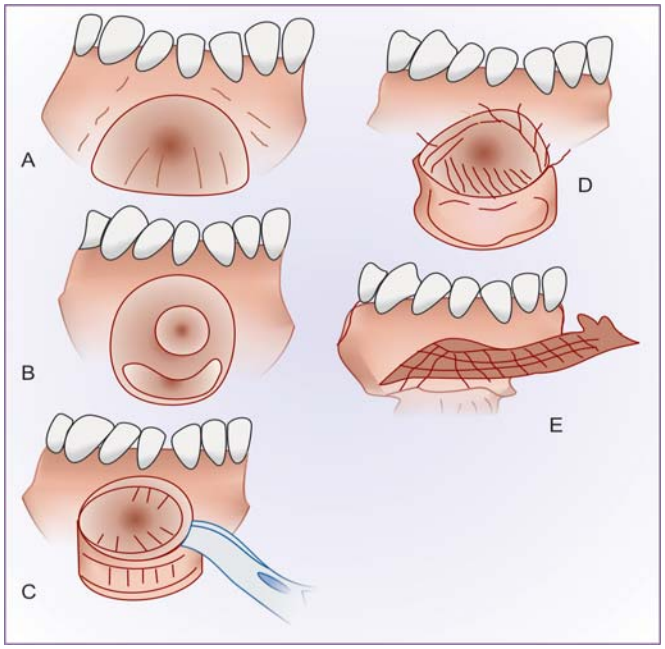
Surgical enucleation.

Calcifying Epithelial Odontogenic Cyst (Fig. 8.10)

Calcifying epithelial odontogenic cyst or Gorlin cyst is a very rarely reported cyst and has no sex predilection. It is common in children and adults about the third decade of life. It was first described by Gorlin et al in the year 1962. It is commonly seen in the anterior part of the mandible. Though it is a rare lesion it discussed more in the various observer different cystic studies. Clinically, the lesion is symptomless and accidentally diagnosed during X-ray examination. Expansion or swelling of the jaw is the most frequent complaint. Rarely, its patients complain of pain. Sometimes the expansion of bone may be extensive,



Figs 8.8A to D: Illustrating the enucleation of a cyst and primary wound closure. (A) A three-sided flap is reflected, (B) Bone is removed to uncover the cyst and the lining separated from the bony cavity, (C) The lining removed. The apex of root-filled right lower central incisor. Note the broad zone of bone around the opening, (D) The flap is sutured into place. Cited from Harris and Seward



Figs 8.9A to E: Illustrating marsupialization of a cyst. (A) A U-shaped incision over the margins of the future cyst opening, (B) A mucoperiosteal flap reflected to reveal a perforation in the cortex, (C) Bone removed to uncover cyst lining which is incised from within outwards flush with the bone edge, (D) The lining is sutured to the edge of the mucosa. Often apex of the tooth of origin protrudes into the cavity and may be amputated flash with the lining. If unroot-filled, a retrograde root-filling can be inserted, (E) The flap is turned into the cavity and packed into place with ribbon gauze soaked in Whithead's varnish. Cited from Harris and Seward.

A **B**

Figs 8.10A and B: X-ray appearance of calcifying odontogenic cyst (Gorlin's cyst. A, Mandible and B, Maxilla with calcification involving lingual as well as the palatal cortex. The cyst may arise close proximity to the periosteum and produce a depression like saucer-shaped in the bone. The displacement of the teeth may also be seen.

X-ray Findings

The small cyst may be seen between the roots of the teeth. The periphery well-demarked or an irregular margin. The lesion may be unilocular or of a multilocular pattern.

Evidence of cortical perforation, may be present irregular radio-opaque specks may be seen within the cystic cavity as calcifications. The cyst may be associated with a complex odontome or an unerrupted tooth. Resorption of the roots of adjacent teeth also may be seen.

Pathogenesis

The cyst has an odontogenic origin and may be derived from remnants of the dental lamina, stellate reticulum and reduced enamel epithelium. The multilocular variant may develop a thick capsule, into which strands of epithelium resembling the dental lamina proliferate, forming daughter cysts.

Histological Features (Fig. 8.11)

Histologically the odontogenic type of lining epithelium is 6 to 8 cells thick and has a columnar or cuboidal basal layer of cells with their nuclei polarized away from the basement membrane. There can be a

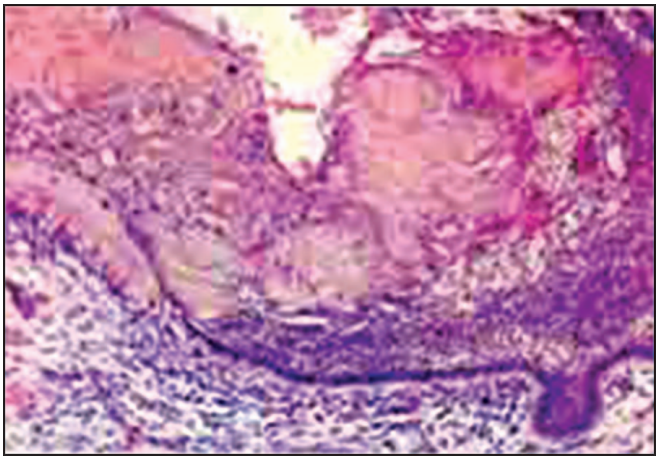


Fig. 8.11: Histological appearance of calcifying odontogenic cyst. "Ghost" epithelial cells seen

superficial resemblance to a keratocyst in a small biopsy. In patches the epithelium proliferates, the cells becoming swollen and then eosinophilic, due to a form of keratinization, but with persistence of pyknotic nuclei. These are called ghost cells. Later these cells fuse and tend to calcify. If pyknotic nuclei are included in the calcified mass it may resemble cellular cementum at first sight. It is the calcification in these epithelial cell masses, which forms the opacities seen in radiographs.

Treatment

Treatment is careful, simple enucleation.

Botryoid Odontogenic Cyst

BOC cyst was reported by Weathers and Waldron in 1973, which is derived from the epithelial cell rests of Malassez. It is thought to be a variety of the lateral periodontal cyst. The macroappearance of the lesion was explained as a bunch of grapes as it resemble are. Hence, it is called botryoid. The cyst is commonly seen in the mandible in the canine – premolar region. X-ray shows polycystic lesions of radiolucency.

Multiple Cystic Lesions of the Jaws

Basal Cells Naevus Syndrome or Gorlin and Goltz Syndrome

The jaw cysts are keratocysts and of the extrafollicular dentigerous (Pseudofollicular) varieties. These cysts start to develop at the time of eruption of the permanent dentition. It may be present symmetrically in both maxilla and mandible, involving the unerrupted tooth or may be scattered in different areas. Jarisch first reported the case and a detailed description was given by Gorlin in 65. It is mostly genetic disorder. The skull is often brachycephalic with frontal and parietal bossing and ocular hypertelorism. Ocular abnormalities are apparent in childhood and a mild prognathism, due to a short cranial base may need orthodontic consultation. Skin lesions include the tiny whitish epidermal cysts or 'milia' around the eyes and tiny circular patches of epithelium may be shed from the thick skin palms and tends to produce fitting. Epidermal skin may develop under the skin in various parts of the body. Subsequently pinkish or white, circular skin plaques are found on the face, check and trunk, which are basal, cell naevi. Complications include transformation of basal cells carcinoma. Ovarin cyst, lipomas, and meduloblastoma a malignant lesion of the brain, in advanced cases.

Cawson describing the Gorlin and Goltz syndrome summarized the characteristic features as follows:

1. Facial with frontal and parietal bossing and broad nasal root.
2. Multiple keratocysts of the jaw.
3. Multiple naevoid basal CA of the skin (milia).
4. Skeletal anomalies usually bifid ribs and abnormalities of the vertebrae.
5. Intracranial anomalies may include calcification of the flaxcerebri and abnormally shaped sellaturcica.

Non-odontogenic Fissural Cysts

1. Median palatine
2. Median alveolar
3. Globulomaxillary
4. Nasoalveolar or nasolabial

} Arise in areas of fusion of facial processes; therefore, collectively called fissural cysts.

5. Nasopalatine or incisive canal cysts

} Arise from remnants of nasopalatine ducts.

Globulomaxillary, median mandibular, median alveolar and median palatine cysts are also described but their authenticity or even the actual existence of some of these entities is in doubt (Harris).

Median Palatine Cyst

Usual location is midline of the palate. Commonly seen in the second to third decade of life. Male and female both are affected equally. Solitary area of radiolucency in midline of palate behind incisive papilla, asymptomatic or may produce swelling in the palate.

Histopathological examination shows cyst lined by stratified squamous or respiratory epithelium.

Treatment: Enucleation.

Median Alveolar Cyst

Usually located anterior to the incisive papilla, and commonly seen in second to third decade of life. Male and female both are affected equally.

Solitary circumscribed radiolucent area in anterior part of midline of palate; asymptomatic or may produce swelling; neighbouring teeth vital.

Histopathological examination shows cyst lined by stratified squamous or respiratory epithelium.

Treatment: Enucleation.

Globulomaxillary Cyst

Usually located in the lateral incisor and canine area. Commonly seen second in the third decade of life. Male and female both are affected equally. Pear-shaped, solitary radiolucency between lateral incisor and canine, neck of "pear" toward crowns, and the cyst produces divergence of roots of canine and lateral incisor; may produce swelling on palatal or labial sides; teeth vital.

Histopathological examination shows the above-mentioned findings.

Treatment: Careful enucleation without damaging the adjoining the roots of the teeth followed by primary closure.

Nasoalveolar or Nasolabial Cyst

The nasoalveolar or nasolabial cysts are rare and arise above the buccal sulcus under the ala of the nose. This cyst is slow growing, lifting the nasolabial fold obliterating and it bulging into both the inferior meatus of the nose and the labial sulcus. A standard occlusal X-ray demonstrates the resorption of the anterior bony aperture. Normally the two inferior nasal margins together with the buttress of the anterior nasal spine produce a 'bracket'-shaped line in this view. A nasolabial cyst converts one half of this line into a concave rather than a convex shape.

Histopathological examination shows cyst lined by ciliated or squamous epithelium.

Treatment: Enucleation.

Nasopalatine or Incisive Canal Cysts (Fig. 8.12)

It is a true non-odontogenic cyst. Usually located behind the maxillary anterior teeth. Commonly seen in the second and third decade of life. Males are affected slightly more than the females.

Solitary, circumscribed, often heart-shaped area of rediolucency behind maxillary incisors, may produce swelling in palate or may be asymptomatic, all teeth vital in the area.

On aspiration: The viscous fluid may contain mucoid material or even pus if the cyst has been infected. This diagnostic aid may help to rule out the normal incisive canal fossa radiolucency.

Histopathological examination shows cyst lined by stratified squamous or respiratory epithelium; connective tissue wall contains nerves and mucous glands.

Treatment: Careful surgical enucleation.

Cyst of the Papilla Palatine

Usually located in the area of the incisive papilla. Commonly seen in second and third decade of life. Male and female both are affected equally. Clinical and X-ray features swelling in area of incisive papilla, sometime produces radiolucency like incisive canal cyst.

HP examination shows the above findings already mentioned.

Treatment: Enucleation.

Median Mandibular Cyst

The mandibular mesenchyme migrates medially from each side and fuses beneath the epithelium to form the mandibular arch. It is less common than the fissural cyst. Commonly seen in the midline of the mandible. There is no sex predilection. The cyst is very small in size about 1 to 3 cm in diameter. The associated teeth are vital. A labial palpable swelling may be present with divergence of teeth. X-ray shows a well-demarcated circular or ovoid radiolucency with the intact laminadura of the involved teeth.

Treatment: Careful surgical enucleation.

Non-odontogenic, Non-epithelium, Cysts-like Conditions, the Traumatic or Haemorrhagic Bone Cyst

This cyst is not fulfilling the criteria of cyst.

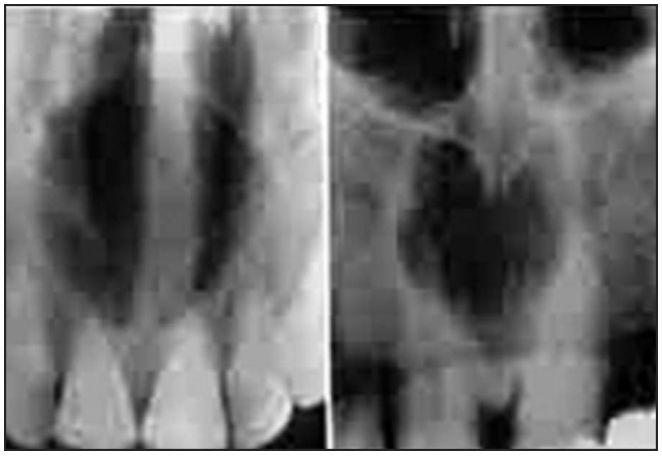


Fig. 8.12: X-ray appearance of nasopalatine cysts showing the peculiar radiolucent heart shape area

Etiopathological Concepts

1. Trauma and subsequent haemorrhage, which fail to get organized.
2. Abnormal calcium metabolism.
3. Chronic low-grade infection.
4. Necrosis of fatty marrow secondary to ischaemia.
5. Spontaneous atrophy of the tissues in a central benign giant-cell lesion.
6. Aberration in the development and growth of the localized osseous tissues.

It is uncommon, and seen in the first and second decades of life, in between 10 to 20 years of age. Males are affected more rather than females as they have more exposure to trauma. It is rarely seen in the maxilla, mostly in the mandible is affected more above the inferior dental canal. The lesion is usually asyamptomatic and accidentally-detected during radiographic examination. The thinning of the cortex and expansion occur at a subsequent stage. X-ray shows as a unilocular cavity enlarging and pushing the interdental bone and the teeth to produce a scalloped outline to the upper border around the roots of the teeth.

On aspiration a deep yellow-coloured fluid may be obtained which contains plasma, proteins and which will clot after sometime. A blood-stained fluid or fresh blood may be obtained. Some cyst reported empty, might contain gases such as N_2, O_2 and CO_2.

Treatment: Surgical exploration and gentle curettage.

Soft Tissue Cysts of the Oral Cavity

Salivary gland retention cysts can be:
a. Mucocele
b. Ranula.

Mucocele

Two types of distinct entities are available. One is a true retention cyst with mucous retention phenomenon, which is lined by epithelium, and the other, is a mucous extra-vasation cyst. A mucocele is a mucous containing cyst that occurs in the salivary gland bearing areas of oral cavity. The mucous extravasation cyst, which occurs, has pooling of mucous. It does not have any epithelial lining and is surrounded by compressed connective tissues (Fig. 8.13).

Etiological Factors

1. Trauma to the secretory acini.
2. Trauma to salivary duct, which is either impinged or severed.
3. Obstruction of a salivary duct.

Site

Usually lower lip and tongue, but it may be seen any where in the oral mucosa. It usually presents as a small-circumscribed elevated lump, translucent and bluish in color. The history of occurrence is usually week or more. Superficial lesions frequently rupture, discharge a sticky mucoid material, and collapse. As soon as they appear to have healed, they recur. This repeated episodic cycle is continuous. Mucoceles are formed because of a traumatic rupture of the excretory ducts of minor salivary glands and the subsequent accumulation of the saliva in the tissues. The retention phenomenon or retention cysts will be partly or completely lined by stratified squamous or cuboidal or pseudostratified columanar epithelium.

Treatment (Figs 8.14 and 8.15)

1. Removal of the cyst along with the injured glands. Since the minor salivary glands lie close to the surface, they usually are removed with the mucocele.
2. Liquid nitrogen cryosurgery.

Fig. 8.13: Mucocele preoperative appearance

Fig. 8.14: Ice crystals formation after application of liquid nitrogen cryotherapy

Fig. 8.15: Mucocele postoperative healing after one week by liquid nitrogen cryotherapy

Ranula

A ranula is a large, soft mucus containing swelling in the floor of the mouth. The term 'Ranula' known as frog's belly. Ranula is identical to the mucocele except that it is associated with a larger gland and is, therefore, of greater size. It is produced by a defect in the Wharton's duct (sub-mandibular gland) or Bartholin's duct (major sublingual gland).

Treatment

1. Partsh procedure (marsupialization) with pack or without pack.
2. Some preferred excision of the cyst along with the gland.

Aneurysmal Bone Cyst

Most authors have described the central giant cell granuloma and the aneurysmal bone cyst as distinct entities. Clinical and therapeutic considerations for these lesions are, however, similar, and in our opinion (Osbon and Lilly), the aneurysmal bone cyst is a histologic variant of the giant cell granuloma. The aneurysmal bone cyst was first described by Jaffe and Lichtenstein in 1942. Though often seen in the long bones and spine, it is rarely seen in the jaws. In past it has been described as a haemorrhagic osteomyelitis, ossifying haematoma or benign bone cyst.

Etiology

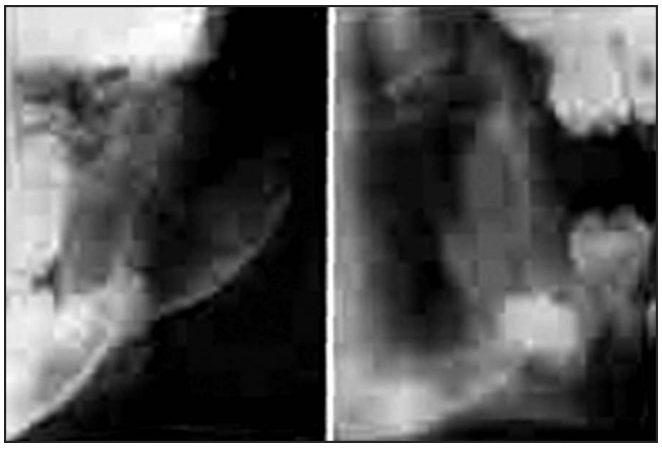
Several concepts have been postulated from time to time.

1. History of trauma.
2. Variation in the haemodynamics of the region.
3. Possible relationship with the giant cell lesion.
4. Sudden venous occlusion.

It is a rare lesion and there is no sex predilection. It is seen in young, adults and children. Mostly seen in the mandible than the maxilla and the posterior region.

The clinical features of the cyst exhibit firm and rapid enlargement. The teeth in the area may show displacement and they remain vital. 'Eggshell' crackling may be present. The lesion is not pulsatile and has absence of bruits.

X-ray appearance of the lesions is usually oval or spherical in shape, and leads to ballooning of the cortex. The lesions are usually unilocular or sometimes may give a multilocular appearance resembling a honeycomb or a soap bubble looks (Fig. 8.16).



A B

Fig. 8.16: X-ray appearance the aneurysmal bone cyst
Note: Trabeculae traversing lesion. A. Frontal view, B. Lateral view

On Aspiration, Dark Venous Blood will come out from the Lesion

Histologically the lesions are composed of a cellular fibrous connective tissues stroma containing numerous multinucleated giant cells and haemosiderin pigments; vascularity is prominent in all lesions.

Treatment

Surgical enucleation and curettage.

Mandibular Salivary Gland Depression or Stafne's Idiopathic Bone Cavity

The etiology as explained by Stafne, that such a depression is a failure of the normal deposition of the bone during development of the jaw. The defect, which is of developmental origin occupied by lobes of sub-mandibular salivary gland.

It is very rare, uncommon, normally seen below the inferior alveolar canal, near to the position of the third molar tooth. It is generally unilateral but bilateral defects have been reported.

Clinical Features

Symptomless lesion discovered during routine radiological examination. The lesions are non-progressive. X-ray shows the depression is rounded or oval about 2 to 3 cm in size. The area of rarefaction is well-demarcated by a dense radiopaque line. Histologically contains normal salivary gland tissue, lymph node tissue or abnormal glandular tissue.

Treatment: No surgical intervention is advised.

Cysts Associated with the Maxillary Antrum

Surgical, Ciliated Cyst of the Maxilla

These cysts are uncommon. They may also be called as iatrogenic cysts, that mean the patient always gives a history of some surgical procedure in the maxilla and also in the maxillary sinuses opened surgically.

Etiopathogenesis

The cyst origin is from the epithelial lining of the maxillary sinuses, which was entrapped in the surgical incision during closure following a maxillary surgical procedure which includes maxillary osteotomies, Caldwell-Luc or maxillary fractures which involved the antrum.

The lesion is present in close proximity to the maxillary sinus and there is no communication between them and it is proved by injecting radio-opaque dyes.

Clinical Features

Patient may complain of a dull throbbing pain in the infra-orbital region. The X-ray shows well-defined radiolucent expansion of the maxilla, with a radio-opaque margin closely related to the maxillary sinus.

Histopathology

The cysts are lined by pseudostratified ciliated columnar epithelium.

Treatment includes Enucleations by Snawdon's Technique (Figs 8.17A and B)

Prof. Fickling in the Charlas Tomes lecture recounts and observes of Snawdon's cases and comments the technique is symptomless and alveolar contour excellent. The technique originally described by Snawdon by enucleating the lining and opening the bony cavity into either the maxillary sinus or the nasal cavity.

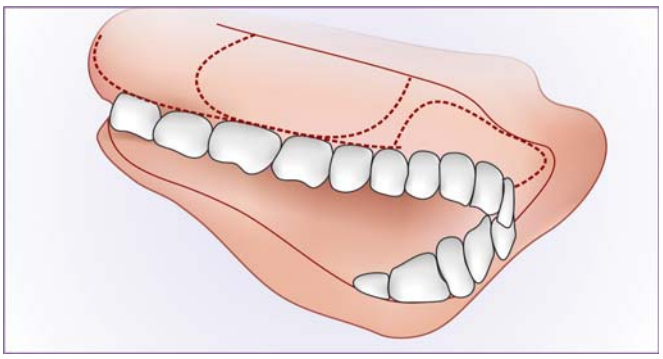


Fig. 8.17A: A diagram illustrating the possible incisions, which may be used; Snawdon's incision is represented by the dot-dash line, Wassmund's by the dotted-line and Seward's by the broken line.

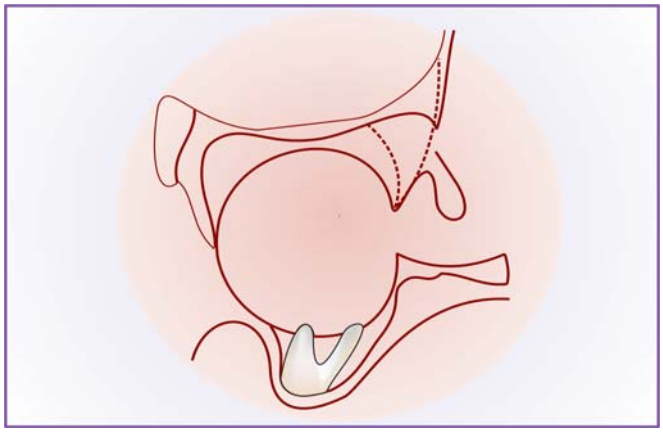


Fig. 8.17B: Snawdon was one of the first British authors to describe the technique of treating large maxillary dental and dentigerous cysts by enucleating the lining and then opening the bony cavity into either the maxillary sinus or the nasal cavity. (Cited from Margarate and Prof Gordon R Seward an observation review article on Snawdon's technique)

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NINE

Role of Oral Surgeon in the Adjuvant Management for the Orthodontic Treatment

• Therapeutic Extraction • Serial Extraction • Extraction of Carious Tooth or Teeth • Wilkinson's Theory • Surgical Exposure • Frenectomy • Pericision • Transplantation of Tooth • Corticotomy • Placement of Implants

The following oral surgical procedures recommended by the orthodontist prior to orthodontic treatment.

1. Therapeutic extraction.
2. Serial extraction.
3. Extraction of carious tooth or teeth/supernumerary tooth/impacted tooth/malformed tooth.
4. Wilkinson's theory.
5. Surgical exposure or uncovering of teeth mostly canine.
6. Frenectomy.
7. Pericision or circumferential supracrestal fibrotomy.
8. Transplantation of tooth.
9. Corticotomy or cortical osteotomy.
10. Placement of implant or bone screw for anchorage.

Therapeutic Extraction

Extraction of teeth is necessary for orthodontic therapy, on the basis of sound diagnostic knowledge. The extraction of teeth is needed for orthodontic treatment is designated as therapeutic extraction.

The premolars are the most-commonly extracted teeth as part of orthodontic treatment modalities. Extraction should be atraumatic, care should be taken to preserve the alveolus, not breaking any buccal, palatal or lingual bony part, it may jeopardize the treatment. The main idea of therapeutic extraction is for creation of space, if there is any crowding.

Serial Extraction

B Kjellgren of Sweden in the year 1929 described serial extraction which is an interceptive orthodontic method, the idea of treating by serial extraction procedure in mixed dentition period, to intercept the development of malocclusion and facilitate the alignment of permanent teeth.

Advantages of Serial Extraction

1. Unerupted/erupted teeth can be guided into proper occlusion.
2. Avoids loss of alveolar bone.
3. Reduce the severity of malocclusion.

Aims and Objectives

1. To make treatment easier.
2. To minimize the extent the orthodontic intervention.

Indications

1. Straight profile.
2. Tooth-size and arch-size discrepancies.
3. Crowding with class–I malocclusion.
4. Crowding primary dentition.
5. Flaring of teeth.
6. Abnormal erupted path and eruption sequence.

Contraindications

1. Convex profile.
2. Severe crowding.
3. Malformed teeth.
4. Deep bite.
5. Impacted canine.

Techniques or Procedures

A number of techniques or sequence of extraction have been reported from time to time.

1. Dewel's technique.
2. Nance's technique.
3. Tweed's technique.

The Dewel's technique proposed three stages extraction procedures.

Stage 1

The deciduous canines are extracted to create space for the alignment of the incisors. This stage is carried out at 8 to 9 years of age.

Stage 2

A year after the first stage, the deciduous first molars are extracted so that the eruption of first premolars is accelerated.

Stage 3

The erupting first premolars are extracted to permit permanent canines to erupt in their place. In some cases a modified Dewel's technique is followed wherein the first premolars are enucleated at the time of extraction of first the deciduous molars. This is frequently necessary in the mandibular arch where the canines often erupt before the first premolars.

Nance's Technique

This technique involves the extraction of the deciduous first molars followed by the extraction of the first premolars and the deciduous canines.

Tweed's Technique

This method involves the extraction of deciduous first molars at age of 8 years. This is followed by extraction of first premolars and the deciduous canine.

Postserial extraction needs fixed appliance therapy for the correction of axial and inclination and detailing of the occlusion.

Extraction of Carious Tooth or Teeth/ Supernumerary Tooth/Impacted Tooth/ Malformed Tooth

It does not require detailed discussion.

Wilkinson's Theory

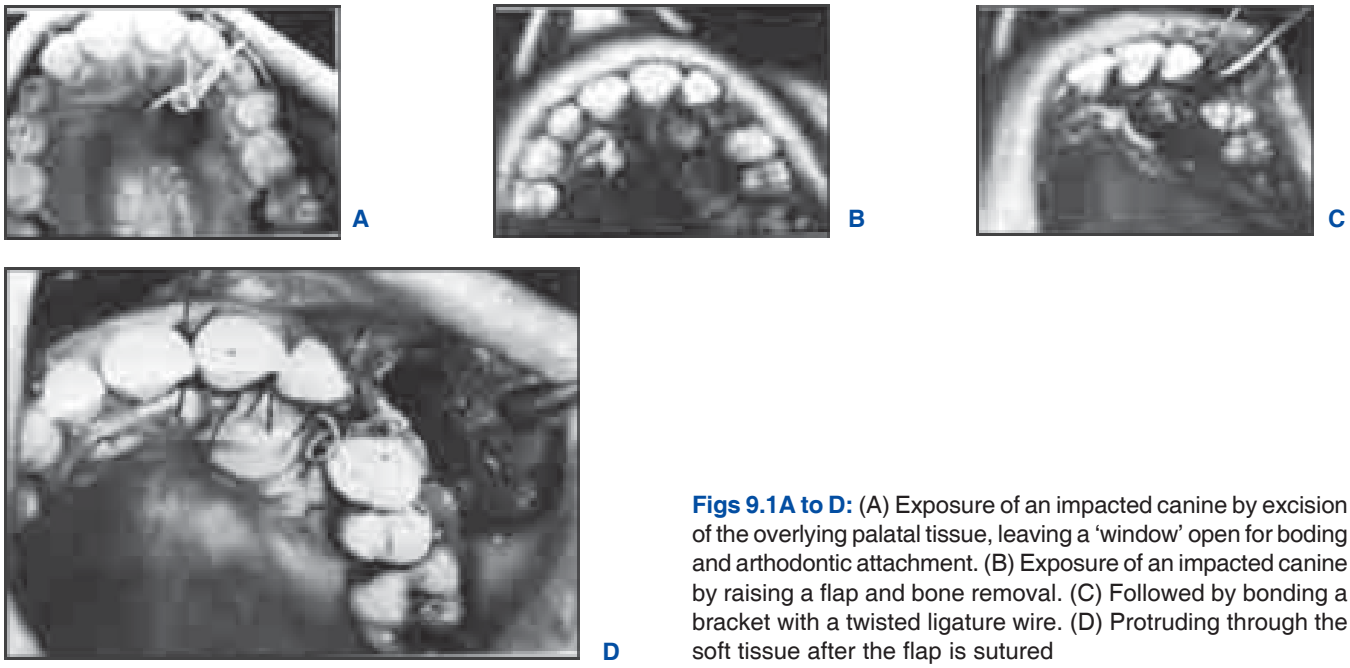
Advocated the extraction of the first permanent molars at the age between 8½ and 9½ years.

The reasons of first molar extraction according to Wilkinson's as because

1. The first permanent molar is highly susceptible to caries—extraction provides additional space for eruption of the molar, the impaction of 3rd molar may be avoided.
2. Crowding of the arch is minimized.

Surgical Exposure or Uncovering of Teeth Mostly Canine (Figs 9.1A to D)

This is usually done in conjunction with an orthodontist. Careful examination and history whether



Figs 9.1A to D: (A) Exposure of an impacted canine by excision of the overlying palatal tissue, leaving a 'window' open for boding and arthodontic attachment. (B) Exposure of an impacted canine by raising a flap and bone removal. (C) Followed by bonding a bracket with a twisted ligature wire. (D) Protruding through the soft tissue after the flap is sutured

displacement of other teeth, the state of the primary canine palpate to see any buldge in palatally or labially.

Radiography I/o parallax assessment is mandatory. Estimation of the depth of the canine within the bone, a lateral cephalogram may help.

Operative treatment: If the canine placed palatally the mucosa around the neck of the canine is to be removed. If the canine placed labially same as above procedure.

The exposure of canine can achieve by removal of bone with great care to avoid damaging the crown or junction with the root. The whole of the greatest curvature of the crown is exposed and, or palatally-placed teeth, and area of overlying mucoperiosteum is excised. A suitable haemostatic agent is used to control of bleeding. Then orthodontists place a band around the canine for orthodontic movement in subsequent therapy for the placement of canine in aligns position.

Fixation of orthodontic band: Attachments are placed on the impacted canine to guide the erupting tooth into the arch. The following attachments that can be placed on the impacted canine are:

a. A metal crown with a hook.
b. A celluloid crown with an attachment bonded to it.
c. Bondable orthodontic brackets or buttons.

A ligature wire is placed in the crown around the attachment and the other end tied to a removable or fixed orthodontic appliance. The wire is gradually tightened at regular intervals to guide the erupting tooth.

Frenectomy

Frenectomy means cutting or removal of the frenum. In general, frenectomy is indicated whenever a frenum causes problems like phonation. High attachment of frenum in which creates restricted movement of tongue difficulty in chewing and opening the pocket for food impaction. This may occur in premolar area.

A frenum also may cause a problem in the area between the maxillary central incisors, thus contributing to a median diastema. The fibers of the frenum cross the height of the maxilla to the incisive papilla. The papilla may blanch when the frenum is pulled. A free gingival graft is performed in conjunction with the frenectomy to prevent a recurrence of fiber attachment to the papilla.

The following criteria should be considered as follows:

a. The frenum should be merely be clipped. It should be totally excised to the bone level.
b. Any palatally-attached fibrous tissues should be removed.
c. Fibrous tissue attached to the intermaxillary suture area should be removed.
d. The mucosa of the lip is undermined to prevent reattachment of the fibrous tissue.

Pericision or Circumferential Supracrestal Fibrotomy

The surgical procedure provides to counter relapse tendency stretched gingival fibers includes trans septal alveolar crest group of fibers.

To achieve and prevent to change the new tooth position or relapse. This method is generally used as an adjunctive retention procedure after the correction of rotation.

Method

- Obtain L.A.
- No. 11 blade of B.P. knife passing through the gingival sulcus around the tooth about a depth of 2 mm apical to the alveolar crest.
- Control the bleeding by using pressure pack and haemostatic agent.

Transplantation of Tooth

According to Wilkinson's theory, the first lower molar is very much prone to caries and this is the most

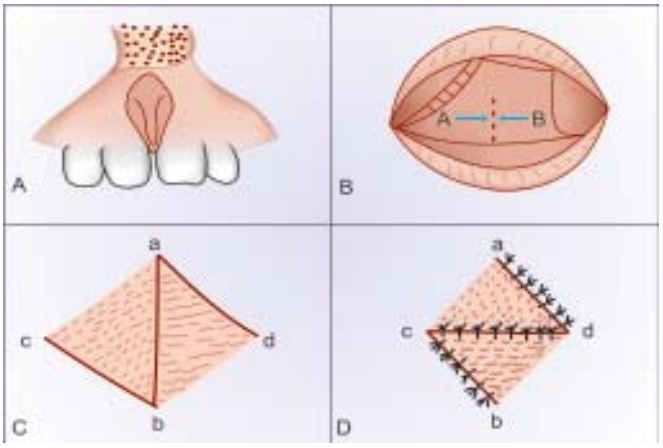


Fig. 9.2: Surgical steps of frenectomy for removal of median diastema

common indication for tooth transplantation. The first molar is automatically removed and the extracted third molar is placed into the first molar socket (lateral trepanation of third molar) that means the developing third molar removed by Bowdler Henry 69 method. Success of the transplant is most predictable when the apices of the roots of the tooth to be transplanted and one-third to one-half formed with open apices and the bordering bony plates are intact.

Corticotomy or Cortical Osteotomy

This is a method of ensuring rapid movements of teeth with their investing bone by utilizing an orthodontic appliance.

In corticotomy, complete separation of alveolar processes is not needed. Bony cuts are made in the cortical plate of bone and only the outer cortex is removed. The medullary bone is left undisturbed. Now it is possible to producing rapid orthodontic movement of the segment. Whenever there is malocclusion with an abnormal basal bone relationship is highly temptating technique to achieve to align the teeth. Cortical osteotomy the basic theme is an osteotomy through the cortex of the alveolar bone at the base of the dentoalveolar segment, which serve the weaken the resistance of the bone to the application of the orthodontic forces.

Placement of Implants or Bone Screw for Anchorage

Placement of implants or bone screw in the edentulous area to work as an anchorage to accomplishment of orthodontic movements commonly used in posterior missing teeth area.

TEN

Pain, PTN and Facial Palsy

• Definition of Pain • Pain Theories • Concept of Facial Pain • Differential Diagnosis • Treatment Modalities • Special Emphasis on PTN (Paroxysmal Trigeminal Neuralgia) and Its Recent Update Overview • Some Observation of Facial Palsy • Special Emphasis on Bell's Palsy and Its Brief Management

DEFINITION OF PAIN

The word pain has been traced to ancient Greek means—a fine or penalty (Costich 1968).

According to Smith et al 1969, the term pain is derived from the latin word *'Poena'* meaning punishment.

Lord Buddha (around 500 BC) attributing to the universality of pain in the life to frustration of desires stated "Birth is attended with pain, decay is painful, disease is painful, union with unpleasant is painful as also is separation from the beloved one".

JJ Bonika 1975, the leading authority on this subject referred to pain as an emotional experience provoked by the tissue injury or described by the patient in terms of tissue damage or both.

Pain is defined as unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage. In this definition, the warning function of pain is clearly identified.

Harris defined pain as it is an unpleasant emotional experience suffered when hurt in either body or mind. It is complex reaction involving all levels of nervous system.

Concept of Basic Pain Physiology

Peripheral nociception: The term nociception derives from Greek word *"Nox"* meaning harm or danger. By nociception is meant all processes that originate in the periphery and lead to pain sensation.

The peripheral pain receptor, which most often is thin, unmyelinated (naked) nerve fiber, is thus termed the nociceptor. All of the tissues in the body except the brain and enamel of the teeth contain nociceptor. The pain process is explained in Figure 10.1.

Anatomy and Physiology of Pain

The stimulus passes from the periphery via the sensory roots and spinal tract of the Vth nerve (also via the cervical roots of VIIth, IXth and Xth) to the spinal nucleus of Vth nerve from which the bultothalamic tracts ascents to the thalamus (Figs 10.2 to 10.4).

Several theories have been postulated from time to time.

Pattern Theory

Specific theory of Von Fry: Specific receptors and specific pathway for pain sensation to pre-nerve endings.

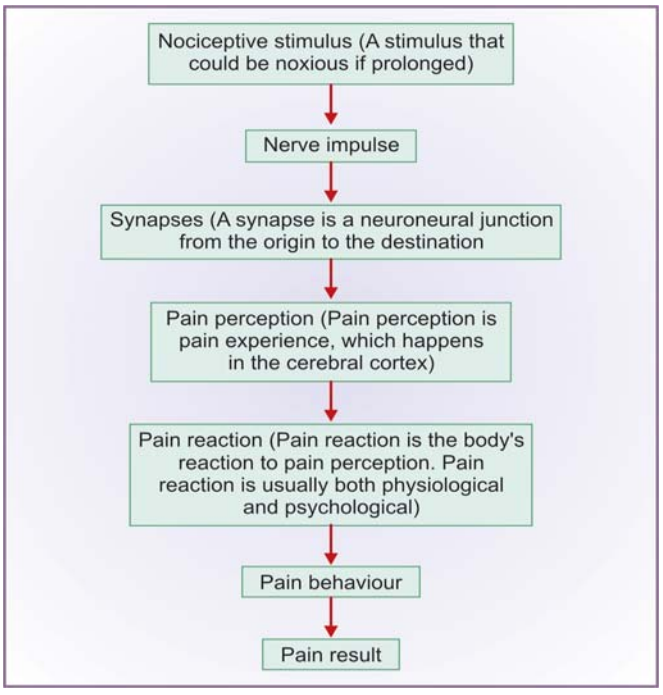


Fig. 10.1: Pain process

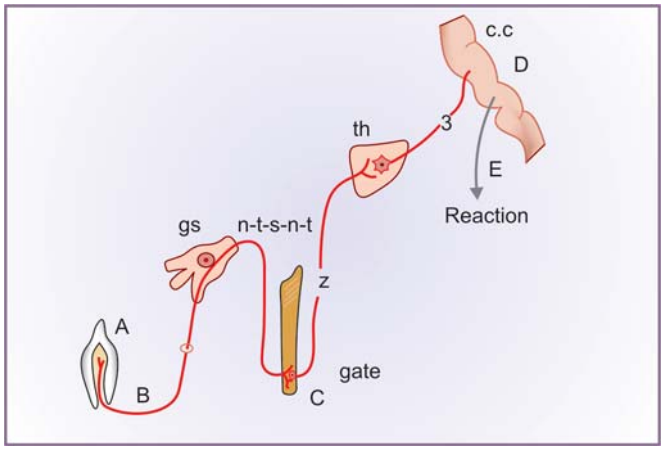


Fig. 10.2: The classic pain track from a tooth to the cerebral cortex involving three neurons. The first neuron via the gs (that means ganglion seminulare), then it passes to n-t-s-n-t (nucleus tractus spinalis nervi trigemini) after reaching the nucleus the synaptic junction of the second neuron, the gate is open and transmit the second neuron to the thalamus. After that, the third neuron transmits the pain perception to the cerebral cortex. Then ultimately projecting the pain reaction

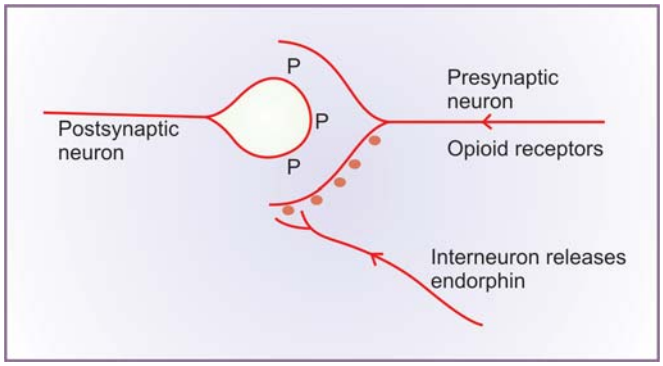


Fig. 10.3: Chemical pain transmitter substance P. The electric pain message is in the synapsis transformed to chemical message as a chemical transmitter substance is released from the presynaptic neuron, crosses the synaptic cleft, and affects the postsynaptic neuron, where the pain transmission continues or is perceived

Gate control theory by Malzack and Well. It is quite accepted and popular theory of pain. Stimulus of the skin leads to impulses going through to brain in three pathways.

- First pathway—Activation of SG cells (substantia gelatinosa of Ronaldo).
- Second pathway—T-cells stimulates central transmission cells.
- Third pathway—Dorsal column stimulation, the central system.
- Large fibre—Stimulates the SG cells.

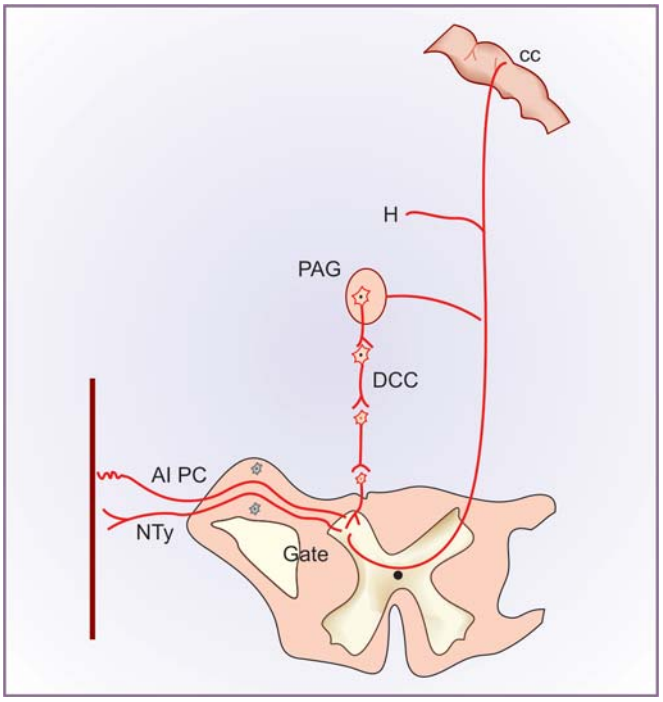


Fig. 10.4: Schematic drawing of the principle of the "gate" control theory, where the gate is situated in the dorsal horn of the spinal medulla

Explanation: A delta fibre stimulated by touch, vibration, acupuncture or high frequency TENS. Non-specific pain-transmitting gamma-fibre. Peripheral control. Descending central control. Peri-aquaductal gray substance. Connections with higher centres in midbrain and brainstem. Cerebral cortex.

- Small fibre—Inhibition of SG cells.
- Both large and small fibres stimulating T-cells.
- Presynaptic inhibition—SG cells.
- Stimulation of large fibres—Gate is closed.
- Stimulation of small fibres—Gate is open.
  1. The cells of SG cells act as a gate.
  2. The control system, which modulates afferent pattern before they influence T-cells.
  3. T-cells activation the neural mechanism which comprised the action system for responsible for perception of pain.

The electric pain impulse is transformed into a chemical message in the synapses and back into an electric action potential in the postsynaptic neuron. The release of the chemical pain transmitter substance P can be blocked by naturally occurring morphine—like substance called endogenous morphines or endorphins. When endorphins are released from small interneurons close to the presynaptic neuron, they attach to opioid receptors on the presynaptic neuron

and block the release of substance P, thus blocking further pain transmission. If this important pain controlling system malfunctions, chronic pain can result. Some instances of chronic pain related to depression have been shown to be characterized by lower-than-normal concentrations of endorphins in the spinal fluid. The interneurons are especially found in the substantia gelationsa of Ronaldo in the dorsal horn of the medulla spinalis and in the brain stem.

These interneurons probably can be activated by both peripheral means and central means.

The peripheral control is activated when mechanoreceptors are stimulated, e.g. by needle acupuncture or by electrical stimulation, or TENS (transcutaneous electrical nerve stimulation).

The central control is activated from some cells in the area around the aquaductus cerebri (PAG = periaquaductal gray substance). This area, in turn, is activated from the cortex cerebri, from the hypothalamus, and from reflex loops from the ascending pain tracts. Also, exogenous administered opioids (morphine, meperidine) can activate the PAG cells and thus the descending central pain control. The convergence of both the peripheral and the central control in the back horn is called the "gate".

If a pain tract is activated many times, pain tract "printing" probably can take place. That is, the pain tract is easily remembered by the nervous system. Next time something happens in the periphery close to the nociceptors of the printed tract, it is likely that the specific tract is activated, and the patient experiences pain to stimulus that otherwise would be subliminal. Pain tract printing is believed to be one source of chronic pain arising in the periphery after acute pain, and also to be involved in postoperative pain. General anesthesia blocks pain perception in cortex cerebri by removing the consciousness. The pain tract, however, is intact during surgery. The brain remembers the pain tract after the anesthesia wears off, and the patient experiences postoperative pain and discomfort in the area. Blocking the area of surgery with analgesics apparently prevents the pain tract printing. In experiments using analgesics for this purpose, patients without exception have experienced less postoperative pain and swelling.

Components of Pain

A. Pain perception,
B. Pain reaction, and
C. Pain threshold.

Pain Perception

Pain perception is pain experience, which happens in the cerebral cortex. The perception of pain is a process that remains unexplained, we do know that the participation of consciousness is necessary. If consciousness is removed by general anesthesia, the brain will still perceive pain by the usual pain mechanisms but the mind will be unaware of it. This perception can be registered by monitoring blood pressure and pulse during general anesthesia. Whenever painful procedures are performed, blood pressure and pulse frequently rise, and it becomes necessary for the anesthesiologist to administer more general anesthetic in order to keep the patient quiet and motionless. It is, therefore, wise to block the pain tract peripherally, by administering local analgesia in the field of surgery, in order to minimize the central input of painful impulses. Blocking the pain tract will decrease the risk of postoperative pain and edema and ensure a more even and smooth general anesthesia.

Pain Reaction

Pain reaction is the body's reaction to pain perception. Pain reaction is usually both—physiological and psychological.

Physiological pain reaction is autonomic response and includes rise in blood pressure and pulse, sweating, paleness, nausea, vomiting and motor withdrawal (pain reflex).

Psychological pain reaction includes the crying, fear, or anger that may accompany pain perception. Pain reaction varies widely from person to person, and also will vary within the same person depending on the person's will of mind and body, and time of the day.

Pain reaction can be lessened by sedatives, nitrous oxide, alcohol, morphine, hypnosis, and suggestive relaxation measures, and increased by fear, depression, previous bad experiences, and unpleasant behaviour of dental team members.

Pain Threshold

Pain threshold is an imaginary factor. It is defined as being inversely proportional to pain reaction, i.e. the more pain reaction the less pain threshold and vice versa. When talking about the pain threshold it is important to define the parameters. A patient is said to have high pain threshold when he exhibits little or no reaction to a painful stimulus, whilst a patient with

a low pain threshold is liable to react violently to an identical or even lesser stimulus. In other words, pain threshold is inversely proportional to pain reaction.

The pain threshold also varies between individuals and in the same individual at different times. Some factors which determine its level include:

1. *Psychological make-up:* Whilst it is readily apparent that emotionally unstable persons have a low pain threshold, it is easy to forget that each and every one of us is affected by our attitude towards the procedure, the operator, and our surroundings. In some patients previous painful experiences have visual or olfactory association which may lower their pain threshold on subsequent occasions.
2. *Fear and apprehension of dental treatment:* Nervous patients become hyper-reactive and tend to magnify pain out of all proportion. It is therefore essential to attempt to secure the patient's confidence by all possible means and as early as possible.
3. *Fatigue:* As tiredness increases the pain threshold is lowered.
4. *Age:* Whilst order patients usually tolerate pain well, children often have low pain threshold and also find difficulty in distinguishing between pain and pressure.

SUGGESTED READING

1. WE Bell (1985). Orofacial pain, classification, diagnosis and management.
2. MR Bond (1979). Pain, its nature, analysis and treatment.
3. GL Howe (1983). Disorder of the masticatory apparatus.

Diagnosis

1. The history is very important for the diagnosis which includes the nature of pain that is sharp, dull, throbbing, burning, stabbing or altered feelings of oral cavity (oral dysasthesia) Duration—may be short or constant. Site and radiation—the history should indicate the primary site of pain and radiate to other areas. Timing onset and frequency. Provoking and relieving factors.
2. Clinical Examination includes (a) visual, (b) probing, (c) percussion (tenderness on percussion is very important feature in case of irreversible pulpitis, periapical, periodontitis and periapical access).

   Special test includes vitality test. X-ray includes periapical and bitewing radiograph and OPG, laser Doppler, transillumination, toothslooth (adjunct for localizing cracked tooth).

Differential Diagnosis of Orofacial Pain

1. Pain arising from teeth and supporting structures.
2. Pain from neighbouring structures, like TMJ, ear, salivary gland, tonsils, eyes, elongated styloid process (Eagle syndrome).
3. Neuralgias—primary neuralgias, e.g. tic douloureux.
   Secondary neuralgias, e.g. mental nerve compression or entrapment, causalgias.
   Fray's syndrome, nasopharyngeal carcinoma (Trotter's syndrome), posttherapeutic neuralgias etc.
4. Vascular pain—migraine, facial migrainous neuralgias, temporal arteritis.
5. Psychogenic pain like atypical facial pain, atypical odontalgia (Idiopathic periodontalgia) by Harris. This can be designate as whole orofacial pain of emotional perspective. The present author influenced and elucidated by Prof. Harris about orofacial pain concept also includes the T.M. joint dysfunction syndrome or myofacial pain dysfunction syndrome and the recent term facioarthomyalgia (FAM).
6. Oral dysaesthesia—This group includes burning tongue—glossodynia, dry mouth, denture intolerance, phantom-bite syndrome, abnormalities of taste, including the obsessional fear of halitosis or a conviction of a 'discharge' from a particular corner of the mouth (cited from facial pain lectures of Prof Malcom Harris).

Oral dysaesthesia or burning mouth syndrome affects females > males 7:1 ratio. They are classified according to the clinical features:

1. *Type I*: Usually asymptomatic on waking from the sleep and increases during the day with a good prognosis.
2. *Type II*: Symptoms present on waking and continue throughout the day associated with significant anxiety or depressive mood. Prognosis is poorer than type I.
3. *Type III*: Intermittent symptoms sometimes involving the other side example floor of the mouth-associated factors may be allergy.

The most common presentations are:

1. Burning tongue—glossodynia or glossopyrosis.
2. Dry mouth in the presence of saliva 'salivary sand'.
3. Denture intolerance.

4. Phantom-bite syndrome is the situation where a patient cannot find position of comfort despite having worn dentures for many years.
5. Abnormalities of taste, including obsessional fear of halitosis or a conviction of a 'discharge' from a particular corner of the mouth.

Factors Responsible for Burning Mouth Syndrome or Oral Dysaesthesia Include the Following

1. Deficiencies of nutritional factors: Fe, Foliate and vitamin B_1, B_6, B_{12}
2. Undiagnosed diabetes mellitus.
3. Ill-fitting denture, which may be unstable or hypersensitivity to acrylic monomer.
4. Mucosal infection, which may be fungal candidiasis.
5. Xerostomia (Treatment: artificial saliva. It is a slightly viscous inert fluid, which has number of additives, such as antimicrobial preservatives that is fluoride, flavouring agent. The preparation available is Glandosane and saliva—orthana as aerosol sprays 4 to 6 times per day).
6. Increase parafunctional activity: clenching bruxism and habit of tongue-thrusting.
7. Psychological factors: anxiety depression and cancer phobia.
8. Allergy denture base material and food additives.

Investigation Includes

1. Total blood count.
2. Assays of Fe, foliate and vitamin B_{12}.
3. Estimation of blood sugar.
4. Smear for *Candida*.
5. Prosthodontic assessment for dentures.
6. Evaluation of psychological status.
7. Patch test for allergic component.

Treatment

1. Reassurance (to explain the benign nature of the problem).
2. Correction of underlying organic pre-disposing factors.
3. Rich nutritional diet.
4. Iron rich, foliate with vitamins and minerals.
5. Neuro-vitamins like B_1, B_6, and B_{12}.
6. Controlled blood sugar and anti-diabetic treatment in case of diabetes mellitus.
7. Correction and replacement of ill-fitting dentures.
8. If the mucosal infection like candidiasis then anti-fungal therapy. Candid (Clotrimazole 1% W/V Sol.) mouth paint 10 to 20 drops gently applied the affected area of mouth 3 to 4 times daily.
9. Use of artificial saliva as glandosen or xerolub 4 to 6 times daily in case of xerostomia.
10. To reduce parafunctional activity suitable bite-guard or occlusal splint.
11. To reduce psychological factors Diazepam 5 mg at bedtime may be adequate especially for cancer phobia. Antidepression, drug therapy is often helpful (please see the chapter drugs and the doses mention in the treatment of FAM) Alprozolam 0.25 mg to 0.5 mg at bedtime and or antidepressive drugs recommended previous discussion.
12. In case of allergy identification of the allergen and treat accordingly.
13. For the burning mouth Tantum oral rinse (0.15% Benzydamine HCl). Prior to consume the main meal rinse the mouth for better consumption of the food without complication.
14. Kamillosan liquid contains Chamomilla oil 15 mg in aqueous base. This can be used as paint 2 – 3 times daily or also used as mouthwash with water.

Pain Arising from Teeth and Supporting Structures

1. *Pulpal pain*: This may be reversible pulpitis (Pulpal hyperaemia). The clinical features include hypersensitivity or pain aggravated to hot, cold or sweet and sour. Pain is usually sharp and throbbing, difficult to locate and subside following removal of the stimulus. Exaggerated response to vitality test for the pulp. There may be leaking restoration and carious cavity.

   Treatment: Removal of the cause includes caries and placement of a sedative dressing (ZOE Paste) with suitable restoration.
2. *Irreversible pulpitis:* Duration of pain may last few hours. Pain is aggravated hot and cold initially in later stage hot causes more pain. The pain is dull and throbbing, difficult to locate but if the inflammation spread to the periapical tissue the tooth become more sensitive to percussion.

   Treatment: Includes removal of the pulp and RCT and suitable restoration. Suitable antibiotics to control infection and suitable analgesic to reliving pain.

Analytical observation: The pulp stone, the nodular calcification within the pulp chamber. This pulp stone may be composed of denticles, and the nodular calcification free, attached or embedded. Sometimes pulp stone causes the neuralgic type of pain referred to adjacent areas. X-ray may have the diagnostic values (reported).

Treatment: Includes the extirpation of the pulp and the pulpectomy followed by suitable restoration.

3. *Cracked or split tooth syndrome:* A sharp pain or biting of short duration, the tooth may have large restoration or history of biting hard substance, subsequently the pain started during chewing. Diagnosis is important for treatment point of view.

   Treatment: Includes restoration with coverage of the tooth if in case of vertical split extends upto roots, extraction of tooth may be required.
4. *Periodontal pain:* Dull continuous relieved initially by clenching but later aggravated. Primary irritation or secondary to pulpitis. Poorly localized Tr. Oral prophylaxis, supra and sub gingival curettage and surgery.
5. *Acute periapical infection* leads to periapical abscess. The pulppal necrosis with periapical infection. The inflammatory changes characterized by with sever throbbing pain associated with disturb sleep. The tooth and the supporting structure tender on palpation. Tooth may be mobile and extruded from the socket there may be localized or defuse swelling.

   Treatment: Includes drainage of pus by opening the canal, and suitable antibiotics if the supporting bone is favourable the RCT and or apical currattage if necessary.
6. *Bone pain:* Dull to severe throbbing (fractures, alveolar osteitis, osteomyelitis, osteoradionecrosis, neoplasia).

   Treatment: On the basis of history, diagnosis and causative factors and treat the case accordingly.

Analytical Observation: NICO means neuralgia: Inducing cavitational osteonecrosis. It is an ischemic osteonecrosis of bone characterized by intermittent pain and degeneration and death of marrow with a slow abrupt decrease in marrow blood flow. This is commonly affected female of age 35 to 60 years. Males and teenagers are also affected. The common sites are third molar region, walls of the maxillary air sinus and the mandibular condyle. It is commonly associated with coagulation disorder, trauma, hormonal disbalance, cancer chemotherapy, profound use of prednisolone and alcohol abuse. Osteonecrosis is not visualized in X-ray. Occasionally shows an admixture of irregular sclerotic and radiolucent areas that means ischemic osteosclerosis with a faint central sclerotic oval zone surrounded by a thick radiolucent circle which is, in turn, surrounded by a thick faint sclerotic ring (Bull's eye lesion) may be identify by MRI or CT scan of bone.

Treatment includes initially antibiotics. Sometimes decortications and curettage may be necessary.

7. *Other conditions:* In these headings the pain may be defuse or patient may localized the pain zone in the following: buried roots, erupting third molar which may cause pericoronitis or impacted tooth and resorbed alveolar ridge where the mental foramen position changed from usual area to superficially near to the upper border of the alveolar ridge. The denture causes pressure symptom on the mental nerve entrapment.

   Treatment: According to the cause.

Pain from Neighbouring Structures, Like TMJ, Ear, Salivary Gland, Tonsils, Eyes, Elongated Styloid Process (Eagle syndrome)

Temporomandibular joint and masticatory muscles: Acute dysfunction moderate discomfort in joint aggravated by chewing, talking, and yawning. Associated trismus and deviation of jaw to painful side on opening. Tender effusion.

Etiology subluxation trapping meniscus or capsule or direct trauma.

Treatment: Rest, soft diet, aspirin, short-wave diathermy.

Acute inflammatory rheumatoid arthritis (uncommon). Treatment—Above plus steroids, etc. Infective (rare). *Treatment*—Chemotherapy.

TM joint dysfunction syndrome or myofacial pain dysfunction syndrome or facioarthomyalgia (discussed in detail in TM Joint Chapter). Dull ache in joint or associated muscles. Often long standing, e.g. many years, intermittent usually without change in intensity.

Timing: Two groups:

1. Wake in morning with pain and trismus, gradually subsides, are nocturnal grinders.

2. Dull ache during day especially after meals of evening when tired. Diurnal clenchester.

May complain of clicking or sticking jaw joints. Tenderness present in masticatory muscles or joint. Pain mechanism, probably release of pain substances due to intramuscular vasodilatation.

Etiology: An infinite range of combinations of emotional stress (see also psychogenic facial pain) and malocclusion. At one end pure anxiety or depression manifested as nocturnal bruxism with a normal occlusion at the other a simple loss of occlusal support requiring partial dentures. (Including common examples such as clenching with or without pipes, pencils, pipettes, erasers, premature cuspal contacts, balancing contacts, ill-fitting, over-closed or over-open dentures. Also, reflex spasm from ipsilateral inflammatory lesions or due to the avoidance of contra-lateral inflammatory lesions.

Choice of Treatment

a. Reassurance and abolition of stress induced habits.
b. Necessary dental care—minor malocclusion does not cause pain.
c. Anxiolytic, e.g. diazepam 5 mg at bedtime. However, the anxiolytic tricyclic drugs such as dothiepin 25–150 mg at night appear to be more effective.
d. Analgesics Mefanamic acid 500 mg or ibuprofen 325 mg with paracetamol 500 mg may be prescribed (Ibugesic Plus) after food.
e. Devices to prevent bruxism, such as a temporary acrylic or soft-bite guard (luciajig or shore appliance recommended by Vambus and Morgan) to be worn at night or in between meals.
f. Psychotherapy where indicated, i.e. intractable cases invariably have an over or latent psychiatric problem.

Chronic inflammatory: Osteoarthrosis.

Treatment

a. Correction of occlusion by prophylatic selective grinding.
b. Analgesics, injection intra-articular steroids.
c. Rarely surgery, i.e. "condylar shave" and TM joint arthoscopy.

2. *Sinusitis:* Severe ache uni or bilateral. Maxillary premolar and molar teeth may be periostitic. Worse on bending. Associated nasal obstruction and discharge. Tender over antrum. Pan sinusitis—widespread facial pain.
Radiograph: Opaque sinus often fluid level.

Treatment

1. Antibiotics, encourage drainage with steam inhalations (nasal decongestant).
2. Intranasal antrostomy (rarely).
3. *Ears:* Occasionally otitis externa referred to mandibular area. Pain on rotating concha.
Etiology: Furuncle or impacted wax.
Treatment: Antibiotics etc.
4. *Salivary Glands:* Dull pain associated with meals and swelling. Establish nature of obstruction.
Treatment: Antibiotics, surgery.
5. *Tonsils:* Quinsy, vincents angina, and acute tonsillitis. Patient present with maxillary pain and some trismus.
Treatment: Quinsy (peritonsillar abscess) incise and drain. Antibiotics.
6. *Eyes:* Rarely acute glaucoma presents as severe facial neuralgia. Associated disturbed vision and high intraocular pressure.
Treatment: Pilocarpine and surgery.

Elongated styloid process: Eagle syndrome. Rare pain on swelling and digital pressure in tonsillar fossa. Evident on radiograph.

Treatment: Surgical (Carefully exclude glossopharyngeal neuralgia and psychogenic pain regardless of radiographs).

Referred from Remote Structures

Angina Pectoris: Dull ache at angle of mandible on exertion. Ischaemia changes on E.C.G.

Treatment: Vasodilators, etc.

Cervical spondylosia: Referral neurologically possible, difficult to prove clinically. However significant correlation between TM joint dysfunction syndrome and cervical pain, i.e. mechanism is reflex (muscle spasm).

Subacute thyroiditis has been reported.

Neuralgias

Primary neuralgias, e.g. tic douloureux (Nicholaus Andre in 1756 coined the term) John Fothergill in 1773 reported the first detailed description of PTN

(paroxysmal trigeminal neuralgia) for that reason it is also known Fothergill's disease.

The clinical features include intermittent paroxysmal lancinating, stabbing, excruciating severe pain along the course of trigeminal nerve. The pain never crosses the midline. The pain started as volleys of jabs (bombardment and severe poker) having the definite trigger zone duration of pain few seconds to less than minute. In between two bouts, there is no pain at all. The patient showing the point of trigger without touching the zone, the finger is half-inch away the point of trigger as because the touching the area pain started immediately so this point is very important known as half-inch sign, positive. Provocating factor includes touch movement, draft of air, talking, chewing and swallowing.

CLINICAL PANAROMA AND DIAGNOSTIC CRITERIA OF PTN AT A GLANCE

Site: Vth nerve mostly mandibular and maxillary rarely ophthalmic division.

Duration: Paroxysmal—complete pain remissions in between the attack of pain.

Sign: Half-inch sign positive with definite trigger zone.

Character: Sharp, shooting, electric shock like pain.

Severity: Very severe, suicidal.

Relieving factors: Sleep, local anesthetic.

Associated factors: Weight loss, anxiety, and depression.

Provoking factors: Non-noxious stimuli, e.g. eating, washing and talking.

Examination: No gross neurological deficit.

Etiology: Mostly Idiopathic

Popular aetiological theories include according to Bayer and Stenger 1979.

1. Lesions within trigeminal ganglionic end or its rootlets.
2. Cerebellopontine angle tumefaction.
3. Aberrant and arterosclorotic arteries.
4. Hyperostosis of the petrous bone.
5. Demyelenation causing plaques at or near the trigeminal roots.
6. Central brain lesion (thalamic cortical).
7. Ischaemic to various portions of the trigeminal system.
8. Viral lesions.
9. Pressure from adjacent structure.

Diagnosis of the affected branch of nerve can be identified by the use of injecting local anesthetic solution to the concern nerve.

Treatment Modalities

Medicinal. Neurovitamins B_1, B_6 and B_{12} used routinely with little and questionable value.

Blom reported the response to anticonvulsants like carbamazepine is highly effective for reliving pain in case of PTN. The carbamazepine can be given tailing or taper the doses may be start with 200 to 400 mg three times daily for 10 to 15 days according to the severity of the cases. When the carbamazepine (tegretol or mazetol) is contraindicated the clonazepam 1.5 mg may be used daily. The side effects include drowsiness, fatigue, lethaergy. Oxcarbazepine 1200 mg per day in divided doses. Side effects include diplopia, hyponatraemia. The recent less toxic agents like baclofen (lioresal) 30 mg in divided doses per day.

Surgical Modalities of Treatment

Injection 95 percent absolute alcohol 0.5 to 1 ml injected to the affected peripheral branches of the trigeminal nerve. After obtaining the local nerve blocked anesthesia. Intra-oral approach is normally used.

After obtaining local anesthesia 1 to 1.5 ml sterile 99.9 percent anhydrous glycerol was injected slowly at the mandibular or intraorbital foramen, depending on the division of the trigeminal nerve affected.

Peripheral Neurectomy or Nerve Avulsion

Intraoral conventional approach by Ginwalla's technique. Incision is made along the anterior border of ascending ramous extending lingually and buccally by a reverse Y incision exposing the medial aspect of the ascending ramus by means of blunt and sharp dissection exposing the mandibular foramen through which the inferior dental nerve passing through the mandibular canal. Another incision is made in relation to mental foramen and the mental nerve is freed. Then from the mandibular foramen with the help of a hemostat gradually screwing the entire nerve is avulsed from the canal. Wound is closed with suture.

Braun's recommended transantral approach 1977, for the maxillary peripheral neurectomy via the Caldwell Luc operation.

Infraorbital neurectomy can be done intraorally via the incision in the canine fossa region raising the muco-periosteal flap and exposing the intraorbital foramen and the same method used before for avulsion of the infra-orbital nerve.

Extraoral peripheral neurectomy recommended by Poppen and Thoma by extraoral Risdon incision (rarely used).

Cryotherapy or cryneurolysis for peripheral nerve: Cryoprobe the temperature of (-) 60° centrigad destroying the nerve sheath and destruction of the nerve cells due to osmotic shock.

Thermocoagulation cordotomy, precutaneous radio-frequency trigeminal neurolysis by Sweet and Wespek later modified and improvised by Gregg and Small under LA fluoroscopic guideline a coaxial radio frequency electrode is introduced through the skin into foramen ovale and gasserian ganglion and stimulation of nerve is carried on, and gradual destruction is created under monitoring.

TENS or transcutenous trigeminal nerve stimulation by O'nell.

Microvascular decompression by Jannetta and Dandy a neurosurgical modalities via the retromastoid approach.

Balloon compression: Under GA this mechanical technique is used to destroy partially by advancing 4 FG Fogarty Catheter about 1 to 2 cm within Meckel's cave and inflating the balloon at the ventral aspect of the ganglion root via a 12 gauge spinal needle passed into the foramen ovale and the balloon catheter is passed through it after the placement of the balloon it is inflated with X-ray contrast guidance remain the inflated balloon for 1 minute. All above procedure mainly under the neurosurgical domaine. The intracaninal procedure is not discussed for the former reason.

Differential Diagnosis of PTN

1. Facial arthromyalgia.
2. Atypical facial pain.
3. Migranous neuralgia.
4. Hemifacial spasms.
5. Eagle syndrome.
6. Atypical odontalgia (idiopathic periodontalgia, phantom tooth syndrome).
7. Trotter's syndrome.

SURGICAL MODALITIES OF PTN AT A GLANCE

The current trend in surgical treatment of PTN is to use less-invasive procedures such as cryoanalgesia (Lloyd et al. 1976; Barnard et al. 1981; Zakrzewska and Nally, 1988), precutaneous retrogasserian glycerol rhizotomy (Hakanson, 1981; Lunsford and Bennett, 1984) radio frequency thermocoagulation of the trigeminal ganglion (Sweet, 1976), radio-frequency thermoneurolysis of peripheral branches of the trigeminal nerve (Gregg and Small, 1986) as well as the injections of affected peripheral branches of the trigeminal nerve with different substances like Alcohol, Glycerol, Streptomycin/Lidocain (Kranzi and Kranzl, 1976; Sokolovic et al. 1986; Stajcic, 1989; Stajcic, 1990). Ginwalla, Poppen and Thoma described the surgical procedure of "peripheral neurectomy" at late sixties, of which Ginawalla's technique is most popular in practice.

Secondary Neuralgias

1. *Extracranial:* Mental nerve compression by denture due to alveolar resorption easily elicited clinically. Old patient with radiological evidence of high foramen.

Treatment: Relieve area or set down nerve surgically.

Mental nerve entrapment: Intermittent severe paroxysmal pain like tic doloreux in mental area. Old patient with radiological evidence of narrowed mental foramen. Occasionally due to Paget's diseases.

Treatment: Decompression of the mental nerve.

Temporomandibular joint osteoarthrosis may be difficult to distinguish from trigeminal neuralgia, and in some cases appears to provoke it.

Treatment: NSAI drugs with intraradicular injection of steroid.

Causalgia: Persistent burning pain usually well-localized in the mandible with a history of traumatic surgical intervention subsequent damage to the nerve.

Treatment: Neurovitamin and reassurance.

Frey's auriculotemporal syndrome: Paroxysmal burning pain in the temporal area associated with flashing and sweating on eating is due to parotid surgery or inflammation rarely due to condylar fractures.

Treatment: Sometimes relieved by avulsion of auricular temporal nerve.

Trotter's syndrome: Nasopharyngeal carcinoma involving the V nerve leads to facial pain and paresthesia, conductive deafness and ipsilateral elevation of soft palate with dysphagia and the affected medial pterygoid muscle leads to trismus.

Treatment: Radiotherapy and chemotherapy.

2. *Intracranial:* Postherpetic neuralgia—following shingles of VN or Ramsay Hunt syndrome (Herpes zoster of geniculate ganglion which may spread to trigeminal distribution). Attacks of severe pain lasting for half an hour associated with scarred areas of ciminished or increased sensation—anesthesia dolorosa. Usually improves in six months to two years.

Treatment: Analgesic for relive of pain. Not amenable to surgery.

Tumors of the posterior cranial fossa, e.g. cerebellopontine angle neurinomas (VII or VIII N) pain, deafness, ataxia.

Middle-cranial fossa lesions include pituitary tumors, carotid aneurysms—pain with disturbances in vision and extraocular movements.

Vascular Pain—Migraine, Facial Migrainous Neuralgias, Temporal Arteritis

Migraine: Hemicrania. Visual disturbances, nausea, ataxia. May, however, be deep steady midline throbbing pain accentuated by sneezing, coughing or head movement.

Mechanism: Spastic dilatation of cranial arteries. Some patients unable to conjugate tyramine to avoid certain foods.

Treatment: Paracetamol 500 mg with metoclopramide 5 mg 1 to 2 tablet at onset of attack followed by 1 to 2 tablet four hourly maximum 6 tablets per day.

Ergotamine tartrate: 1 to 2 mg orally or by suppository. 0.36 to 0.72 mg by inhaler.

Severe cases: 0.25 to 0.5 mg ergotamine tartrate IM with 50 mg cyclizine lactate. Methysergide 6 to 12 mg orally (side effects angina pectoris, retroperitoneal fibrosis).

In pregnancy and vascular disease Prochlorperazime 5 mg short courses of a tricyclic antidepression, e.g. motival (Fluphenazine and nortriptyline) 1 tablet at night can be useful as prophylactic measure.

Facial migrainous neuralgia (Horton's syndrome, Sluders syndrome, cluster headaches, histamine cephalgia, sphenopalatine neuralgia, alarm clock headache, etc.)

Intense pain in the periorbital region, usually at night, associated with sensation of nasal obstruction, and conjunctival hyperaemia. Attacks last about half an hour, and characteristically occur in groups, i.e. nightly or alternate nights for several weeks followed by remission. Some patients provoked by alcohol. Occasional migraine patients also have features of TM joint dysfunction syndrome, and should be treated for anxiety or depression.

Treatment: Includes prophylaxis.

Indomethacin, beta blockers, methysergide 6 to 12 mg orally daily and calcium channel blockers.

Incase of acute episode therapeutic oxygen and Sumaptriptan.

Giant cell arteritis: Vascular pain syndrome of the temporal region, can affect other branches of the external carotid artery. Severe localized pain in older age if internal maxillary branches involves, intermittent claudication on eating in muscles or mastication and tongue. Involvement of ratinal or cilliary vessels may cause blindness.

Investigation and diagnosis: Elevated ESR and C reactive protein level during acute phase. Normochromic, normocytic anaemia in 50 percent of cases.

Temporal artery biopsy demonstrates infiltration of artrial wall with giant cell. Early diagnosis and treatment is important on the prospective of potentially serious ophthalmic complication.

Treatment: Includes systemic steroids immediately. High doses are recommended with the consultation of medical specialist and ophthalmic surgeon.

Psychogenic Pain

This pain like atypical facial pain, atypical odontalgia (Idiopathic periodontalgia) by Harris. This can be designates as whole, 'orofacial pain of emotional perspective'. The present author influenced and elucidated from Prof. Malcolm Harris about orofacial pain concept also includes the TM joint dysfunction syndrome or myofacial pain dysfunction syndrome and the recent term facioarthomyalgia (FAM) (This topic is already discussed in TM joint Chapter).

Atypical Facial Neuralgia

Dull or throbbing pain of long standing in non-muscular parts of face or in jaws and teeth. Often associated with migrainous pains elsewhere. Unilateral, midline or bilateral–varies. Attacks may last weeks followed by remissions. Patient usually presents with a history of unnecessary extractions. Teeth may be tender to percussion even where non-carious and vital. Mucosa often hyperaemic. Incompletely abolished by local analgesia of trigeminal nerves. A significant number of patients have an underlying depressive illness.

Cause

This has the characteristics of a vascular pain. Possibly local muscular activity such as bruxism produces painful vaso-dialatation which persists due to inadequate catecholamine activity which is a feature of depression. Both pain and depression respond to tricyclic or meno-amine-oxidase inhibitor anti-depression, e.g. dothiepin 25 to 75 mg night initially—then increasing to maximum tolerated dose over 3–4 weeks. NB relief may not be achieved for up to 8 weeks.

Mono-amine-oxidase inhibitors e.g. Phenelzine 15 mg at 8, 12 and 4 pm and diazepam 5 mg nocte. Refractory cases should also be provided with a bite guard.

Unfortunately, some patients strongly resist a diagnosis of depression and psychiatric help but insist on an organic diagnosis. Invariably this gives rise to fruitless operative procedures.

Atypical Odontalgia (Dental Migraine)

Throbbing dental pain with hypersensitivity of one or more teeth to all stimuli – indistinguishable from pulpitis. Often widespread or bilateral. Commonly precipitated by dental treatment and made worse by further intervention. Appears to be a hyperalgesia of the pulp and periodontal receptors due to vaso-dilatation.

A careful history reveals significant emotional problems in most patients. These patients are best considered to be a variant of atypical facial neuralgia. The temptation to devitalise or extract teeth mist be strenuously resisted.

The various terms are used in neurological disturbances, which are as follows:

- *Paresthesia* and abnormal and altered sensation, whether spontaneous or evoked.
- *Paresis* means partial dysfunction.
- *Anesthesia,* loss of sensation.
- *Local anesthesia* preferably termed as local analgesia, loss of pain sensation in response to the stimulus.
- *Dysaesthesia* already discussed above.
- *Hypokinesia* means diminished movements.
- *Neuritis* inflammation of the nerve.
- *Neuralgia* transmission of pain impulse passed along the distribution of the nerve or nerves.
- *Neuropathy*—A disturbance of function or pathological change in a nerve.
- *Nerve injury,* which includes:
  - — *Neuropraxia* is characterized by a conduction nerve block, which is reversible.
  - — *Seddon and Sunderland* proposed two classifications related to nerve injury, which applied to motor as well as sensory nerves.
  - — *Tinel's sign* earlier indicates the initiation of nerve regeneration. Recently, electroneurography diagnostic study shows for evidence of reinnervation.
  - — *Axonotmesis* it represents the axtional injury with subsequent degeneration and regeneration. Tortion, compression and traction are the most common cause.
- *Neurotmesis* – it is a severe disruption of the nerve trunks with irreversible recovery. This injury caused by laceration, avulsion or chemical injury. Its damage to all components of the nerve trunk includes axon, endoneurium, perineurium and epineurium.

Facial Palsy and Bell's Palsy

The facial nerve has a complex course from the brainstem through the temporal bone and the parotid gland, before innervating the muscles of facial expression. Running along side this motor nerve are sensory fibres conveying test from the anterior 2/3rd of the tongue via the chorda tympani. The motor root supplies to the muscles of the face and associated muscles. The preganglionic parasympathetic (secretomotor) fibres to the submandibular, sublingual salivary gland, lacrimal gland and gland of the nose.

Damage to the facial nerve results in facial weakness and a considerable cosmetic deformity. The neurological level of damage determine the clinical picture.

The upper part of the face receives bilateral upper motor neuron innervation from both cerebral hemispheres whereas the lower part of the face receives upper motor neuron innervation from the contralateral hemisphere. Thus, the upper motor neuron affects only the lower part of the face on the opposite side while a lower motor neuron lesion affects the whole of the face on the ipselateral side.

Upper Motor Neuron Lesion

Acoustic neuroma, CVA, multiple sclerosis, lower motor neuron lesion, Bell's palsy, trauma may be surgical or temporal bone fracture. Cerebellopontine angle tumors then malignant parotid gland, middle ear infection, sarcoidosis.

Clinical pictures consist of weakness of facial muscle leads to paresis that means partial dysfunction.

Loss of motor function (movements) is called facial paralysis represent difficulty in consuming fluids and difficulty in masticatory function, there may be drooling of saliva outside the mouth. Loss of protection for cornea of the eye can lead to pain infection and visual disturbances due to corneal ulceration. Facial asymmetry leads to cosmetic disturbances.

Management includes reassurance to the patient and sought the cause and removes the cause and treats the consequence of the cause. Bell's Palsy defines as unilateral idiopathic LMN paresis or paralysis of sudden onset of the facial nerve described by Sir Charles Bell in the year 1828.

Women are more affected than the male. The disease is more common in pregnant women.

Jackson et al in the year 1999; summarized the initiating events or phenomenon a related to Bell's Palsy:

- Acute otitis media.
- Atmospheric change of pressure (diving, flying).
- Exposure to cold.
- Ischemia of the nerve near the stylomastoid foramen.
- Local and systemic infection (viral, bacterial, fungal).
- Melkersson – Rosenthal syndrome.
- Multiple sclerosis.
- Pregnancy (third trimester, early eclampsia).
- Diabetics. It can occur in any age.

Etiology

Bell's Palsy: According to definition it is an idiopathic condition. Various theories have been postulated from abnormal immunological response to reactivated herpes simplex virus and infection in the geniculate ganglion. There are various hypothesis from rheumatic ischaemic immunologic viral and cold hypothesis of which cold exposure proposed by Charles Bell and the viral infection and ischaemic hypothesis having the reasons on etiological point of view.

Clinical Features

Includes sudden onset usually early in the morning after sleep. Loss of muscle control of one side of the face. Inability to smile, close the eye or wink or raise the eyebrow on the affected side. Not able to close the eye leaf. Attempt to close the eye, the eye–ball rolls upward this is known as Bell's sign.

Inability to wrinkle the forehead lacrimation, slurred speech, drooling of the saliva due to drooping of the angle of the mouth.

Investigation includes audiometry C.T. scan or MRI and EMG may be considered.

Management includes referring and consultation with ENT and Neurosurgeon as well as Ophthalmologist.

Medicinal management includes injection, vitamin B_1, B_6 and B_{12}. Prednisolone 80 mg daily for divided doses for 5 days, then gradually tailing off the doses consequent the next 5 days.

Physiotherapy includes galvanism stimulation, gentle massage and facial exercise. In chronic sequelae includes hyperkinesias or hypokinesias. In hyperkinesias offending muscles group are denervated by *Clostridium botulinum* toxin (botax) is a neurotoxin that temporarily interferes with acetylcholine release from motor nerve endplates, causing skeletal muscle paralysis. The affect last four to six months. Botax has been useful in the treatment of facial palsy by weakening the contralateral side to allow centering of the mouth to achieve symmetry of the face during smiling.

Hypokinesia needs nerve transfer, muscle transfer or static slings. Other treatment includes nerve decompression, internal and external decompression, nerve reanimation and nerve grafting.

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ELEVEN

Diseases of Maxillary Antrum

• Anatomy and Physiology of Maxillary Antrum • Inflammatory Conditions of the Maxillary Antrum • Clinical Features and Radiological Analysis with Special Emphasis on Sinus Endoscopy • Removal of Displaced Root by Surgical Procedure • Repair of Oroantral Communication and Oroantral Fistula by Various Surgical Modalities • Classification of Malignant Tumors of the Maxillary Air Sinus and Diagnosis • Brief Management (Cysts of the Maxillary Antrum Discussed in Cyst Chapter)

ANATOMY AND PHYSIOLOGY OF MAXILLARY ANTRUM

Maxillary air sinus or antrum of Highmore can be described as an air-space in the body of the maxilla. Nathaniel Highmore first reported in the year 1651. It is pyramidal in shape. Size, vertically 3.5 cm anteroposterior, width 3.2 cm, transversely 2.5 cm. The floor of the orbit forms the roof of the antrum; the alveolar process of the maxilla, which extends from the second premolar to the molar teeth, forms the floor. Anterior wall is formed by the posterior surface of the anterior wall of the body of the maxilla. Posterior wall is formed by the anterior surface of the posterior wall of the body of the maxilla. Apex is formed by the zygomatic process. The medial wall of the body of the maxilla forms base, where lie the maxillary meatus.

Function

1. Makes the cranial bone lighter (disapproved by Prof RJ Last).
2. Act as a resonant box.
3. Regulates the temperature of the inspired air.
4. Drainage.
5. Pneumatisation.

The ostium draining the sinus enters the middle meatus. Ciliated epithelium lining the sinus wafts continuously to the exist.

Arterial supply: Facial, infraorbital greater palatine.

Nerve supply: Infraorbital, anterior middle, posterior superior alveolar nerve.

Venus drainage: Facial and Ptg. venus plexus.

Lymphatic drainage into the submandibular nodes.

Importance of Surgical Anatomy of Maxillary Air Sinus

1. The distance is approximately 1 to 1.25 cm between the floor of the sinus and root apices of the maxillary posterior teeth and it is also in close proximately with the roots of these teeth. The roots of the second molar were closest to the floor of the maxillary sinus as per the study of Bornsdorff. It was also supported by Paatero in the year 1939.
2. Lining of the maxillary sinus does not usually get torn, if undue force of an extraction is applied.
3. Cracks and fractures in the bony floor of the maxillary sinus. There may be chances of an oroantral communication or this may heal even if there is accompanying tear in the sinus lining.
4. *Periapcial infection*: Infection in the form of chronic abscess in teeth related to the floor of the sinus may involve the maxillary antrum. The extraction of such a tooth leads to an oroantral fistula by contamination from the infected blood clot.
5. Pressure of the nerves within the antrum. Acute maxillary sinusitis sometimes produces pus, which is unable to escape from the ostium into the nose due to inflammatory reaction of adjoining mucosal lining.
6. Tumors involving or developing in maxillary antrum. Tumors within the maxillary antrum also penetrate floor of the maxillary antrum and present as a palatal lump or expansion in the buccal sulcus. The teeth in the area may get mobility due to destruction of surrounding bone. The tumor may extend to the orbital floor and may cause paresthesia of the infraorbital nerve.

7. The various foreign bodies within the maxillary sinus. The foreign bodies includes tooth or roots fragments or any other objects, may change position with movement of the head. If the foreign body does not move in consecutive radiographs the chances are of foreign body hence trapped into thick antral mucosa or any polyp or it may present between antral lining membrane and the bony septa.

Radiology of Maxillary Sinus

Extraoral

1. 15 and 30° occipitomental. Reveal antral opacity, fluid level of the antrum or fracture maxilla.
2. Occipitofrontal is recommended to detect multi-sinusitis and pan sinusitis.
3. *Lateral skull*. Confirms the presence of fluid level and cyst and localizing a tooth root when it is located higher up in the sinus.
4. Submento vertex.
5. *Linear tomography*. This method demonstrates the solid masses within the maxillary antrum such as antroliths and osteoma. This also shows early erosion of the walls of maxillary antrum due to involvement of malignancy of the maxillary antrum.
6. OPG for detection of lesions like odontogenic and mucosul cyst of maxillary antrum.
7. *Computerized axial tomography* (CAT). This scan is for better detection of a growth within the maxillary antrum and in blow out fractures.

Intraoral

1. Occlusal
2. Lateral occlusal
3. Periapical.

} The intraoral X-ray are of great value in locating the foreign bodies such as tooth, roots and osseous fragments and for treatment plan. It may help the different phases of opacities. However, it is impossible to diagnose purely by radiological means.

Special Diagnostic Tests in Addition to the Radiological Methods

1. Sensibility test (vitality).
2. Transillumination test.
3. FNAC
4. FESS (Functional endoscopics sinus surgery): The main objective is to restore the normal function of the para-nasal air sinuses with mucociliary activity. The first description of endoscopic examination methods of the nasal cavity and the antrum cavity reported by Maxwell and Maltz in the year 1925. They suggested sinus copy should be utilized for diagnosis, and explained the maxillary endoscopic sinusotomy via the inferior meatal and canine fossa roots. This method was improvised and developed by Messerklinger and Wigand in the year 1978. Subsequently Stamberger and Kennedy with the help of CT scan and pluridirection tomograms improved the original technique described by Messerklinger. In endoscopy of the maxillary sinus topical anesthesia is applied to the sublabial zone over the canine fossa. Then 2 percent xylocaine with 1: 80000 adrenaline, about 1 to 1.5 cc is injected in that area. A small stab incision is made with a BP blade No. 11 over the mucous membrane. Then a trocar is used to enter the upper lateral part of the canine fossa. Care should be taken about the protection of the eye to fill the orbital rim and place a finger on the rim during the puncture of the sinus. The trocar and cannula are slowly-rotated while entering the sinus in the posterior direction. Then the sinus may be examined with a telescope. A biopsy can be obtained with an optical biopsy process via the cannula. The patient is asked to avoid blowing the nose for at least about a week postoperatively to avoid subcutaneous emphysema. The FESS technique was classified by Anand and Panje's into V types of which type III which includes the type II that is nasal endoscopy plus maxillary sinus antrostomy via the natural sinus osteium. Usually recommended in this chapter.

Maxillary sinusitis can be explained as acute and chronic varieties. The odontogenic sinusitis cause is due to infection from the tooth and associated structures. These may depend on the different phases of inflammatory conditions. The acute maxillary sinusitis is considered as acute inflammation of the maxillary antrum. Patient complains of throbbing pain associated with severe headache with irritability, nasal congestion running nose, sneezing may or may not be present, and pyrexia, and sometimes, lacrimation on the affected side. There may be a history of cold exposure. It may lead to throat and bronchial infection. Patient may complains of pain on the biting of the affected side. This may be due to increase of vasodilation of the periodontal ligament. Obstruction of the maxillary opening or impairment of ciliary activity due to intrusion of snuff. The antral cavity may form pus, and may discharge it via the nose or involve the tooth inside the oral cavity.

X-ray Shows the Haziness in OMV/Water's View Recommended by Water and Waldron

Infection may track from the oral septic focus or via the nasal cavity. Repeated episodic attacks of prolonged sinusitis leads to the sub-acute or chronic variety. The antral lining may be transformed to hyperactive plastic or atrophic variety ultimately to form antral polyps or an antrolith. Patient complains of halitosis with bad taste. There may be a purulent discharge from the nose, accompanied at times by a postnasal drip.

X-ray shows thickening of the antral lining with haziness or opacity of the affected antrum, and this may be evaluated with a comparative examination of both sides of the maxillary air sinuses.

Treatment

1. Tinc, Benzoin CO or carvol inhalation. The simple steam inhalations containing the drugs mentioned, to act as mucolytic agents.
2. Nasal decongestant like cetirizine.
3. Nasal drops like 0.5 to 1 percent ephedrine sulfate in normal saline 6 hourly. 0.1 percent xylometazolin hydrochloride. This decongestant not only shrinks the congested and inflamed mucosa but also helps to minimize and eliminate the mucosal discharge.
4. Selective course of suitable antibiotic to control infection.
5. Maintenance of oral hygiene.
6. Paracetamol 500 to 750 mg. in case of pain, or preferably NSAI drugs.
7. Omit the use of snuff. If the patient is using the habit.

Diagnosis and Management of the Displaced Root in the Maxillary Antrum (Figs 11.1 to 11.3)

The accidental displacement of a tooth or a fragment of a tooth or root into the maxillary sinus during exodontias is a common experience. The diagnosis of a recently displaced root in the maxillary sinus is obvious as a rule. A history of sudden disappearance of a root fragment from its socket during manipulation together with a breach in the floor of the maxillary sinus, is strongly suggestive of such a mishap.

In a periapical radiograph, the displaced root fragment is usually seen to be lying near its socket and is devoid of its normal surrounding periodontal membrane and lamina dura. Alteration of its position in a successive radiograph after the patient has vigorously moved his head, is confirmatory evidence that the root is inside the antrum. However, such a root often becomes in carcerated by a blood clot, and is unlikely to shift in spite of vigorous movements of the patient's head.

Instead of being dislodged into the antrum a root fragment may be displaced into other tissue planes such as the extramucosal site, i.e. outside the antral mucosa, the subperiosteal plane, or intrabuccally, i.e. within the buccal soft tissue. Obviously it is extremely

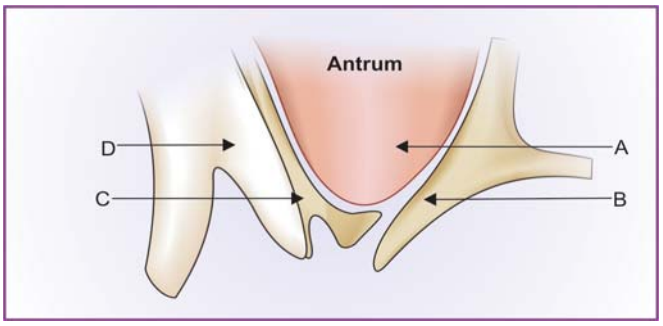


Fig. 11.1: Diagrammatic coronal section of antrum showing various positions of a displaced root. (A) Intra-antral, (B) Extramucosal. (C) Subperiosteal, (D) Intrabuccal

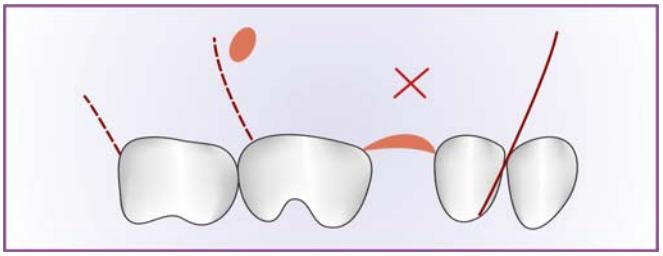


Fig. 11.2: Outline of two-sided flap in heavy shade, X, retained root or similar. A line of additional incision to convert to a three-sided flap

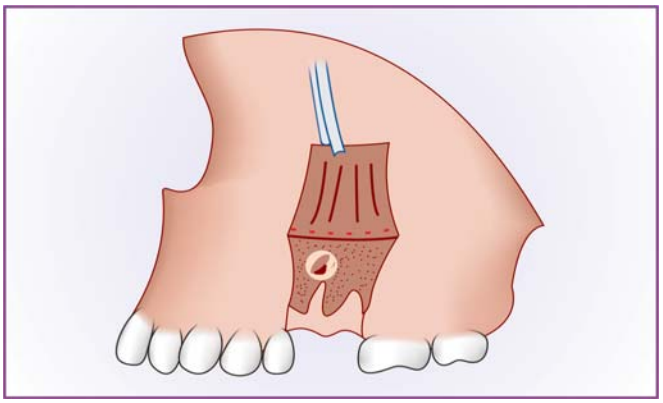


Fig. 11.3: The figure shows the Lee transalveolar approach for removal of root from the maxillary sinus—The incision, and raising the mucoperiosteal flap

difficult, if not impossible, to differentiate these various positions of the displaced root on radiographic examination.

Management

Whatever may be the position of a displaced root, it should be removed as an emergency procedure at the time of a displacement or at the earliest opportunity. For removal of a root from the maxillary sinus two surgical approached have been employed.

1. Caldwell-Luc method via canine fossa.
2. The approach at the site of the tooth socket by enlarging the existing antral perforation and recovering the root via the enlarged opening in the tooth's socket.
3. FMS LEE recommended a technique of approach of the antrum from the buccal aspect, immediately above the tooth socket. According to Lee this opening gives the operator a maximum visual and mechanical access as well as a better view of the floor of the antrum adjacent to the tooth socket, and it is also less likely to lead to the formation of an oroantral fistula. This simple technique was described by Lee as transalveolar approach under local anesthesia. A trapezoid incision is given on the buccal aspect of the respective tooth socket. A mucoperiosteal flap is raised, and the buccal plate of the alveolar bone is first removed with a rongeur. Removal of bone is extended beyond the apical limit of the socket, which immediately exposes the antral mucosa. An exposure of about 1cm in diameter is adequate as a rule. If there is any indication that the displaced root may not have penetrated the antral mucosa, e.g. if the antral mucosa has not been breached, then the other tissue planes should be carefully explored at this stage. Otherwise the antral mucosa is incised across the full extent of the bony window exposing the antral cavity. If the root has not been displaced far from its socket, it may come into view, in which case it can be removed under direct vision on the tip of a suction nozzle or with any other suitable instrument such as a pair of fine hemostats.

If the root is not visible, the sinus is then irrigated with normal saline solution while an efficient suction nozzle is placed inside the antrum so that the root fragment may be recovered on the tip of the nozzle, as is often the case. This is preferable to having the root flushed out into the oral cavity, where it may be lost.

Subsequent to the recovery of the root, dividing the underlying periosteum of the buccal flap and advancing the flap in a manner originally described by Rehrmann meticulously close the antral opening together with the socket. Long tails of the sutures are left so that they may be used to secure a small dressing of ribbon gauze in Whitehead's varnish packed over the tooth socket for its protection.

Postoperative Instruction and Advice

1. Cap amoxycillin 500 mg three times daily for five to seven days or Tab erythromycin 500 mg four times daily five to seven days.
2. Non-steroidal anti-inflammatory analgesic usually ibuprofen 400 mg with paracetamol 300 mg for first 24 hours three times daily and this may be continued for another 48 hours, and instead of three times, twice daily or suitable analgesic may be given.
3. Nasal decongestant drops 0.1 percent xylometazoline hydrochloride may be used three to four times daily.
4. Chymoral forte 1 tablet half an hour before meals or one hour after the meals three times daily for three to four days to reduce the postoperative edema.

Advice

1. Not to blow air via the nose. Avoid sneezing, vigorous coughing and smoking.
2. Saline mouth bath after 24 hours.
3. Ice application from outside for first 1 hour to reduce the hematoma.
4. Soft semisolid diet for first 24 hours.
5. Remove the pack after 1 hour.
6. Report after 10 to 14 days for removal sutures.
7. In case of emergency, contact the concerned surgeon.

Oroantral communication can be defined as an accidental opening between the oral cavity and the maxillary sinus. The close proximity of maxillary second pre-molar and first molar to the maxillary air sinus is of great value.

Clinically this can be explained as 5 S.

1. Sudden loss of resistance during extraction, that means the application of the beak of the forceps, and the tooth may be pushed or intruded within the socket.

2. Seepage of fluid or water from the nose.
3. Sudden alteration of voice or phonation.
4. Sudden leakage of air from the extracting socket (nose blowing test positive).
5. Sudden bleeding from the nose (epistaxis)

Closure of large accidental sinus opening in the dentulous arch recommended by Phillip Earle Williams—cited from Gustav Kruger (Fig. 11.4).

Fractured maxillary tuberosity during extraction of posterior teeth may lead to a large accidental opening of oroantral communication. If the bone cannot be dissected from the roots, it should be carefully dissected from the overlying mucosa and the tooth and tuberosity removed together. An extensive communication with the antrum results but careful preservation of the mucosa leaves ample tissue to achieve a watertight closure (Fig. 11.5).

Oroantal fistula can be defined as a creation of a pathological epithelium lined tract between the oral cavity and maxillary sinus. This may often occur following the extraction of an isolated molar teeth when the fistula tends to persist. The features of four 'S' present in oroantral fistula except the first one.

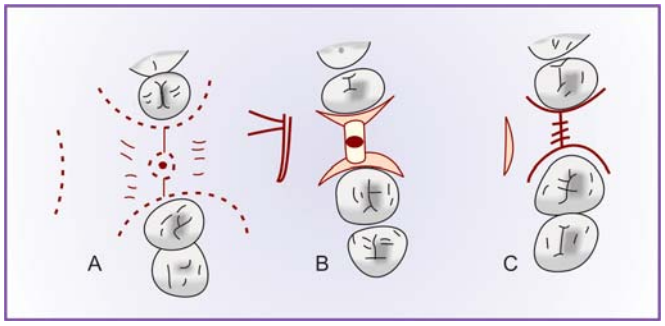


Fig. 11.4: (A) Relaxing incision is made on the palate, avoiding the palatine artery. The buccal and lingual alveolar walls are reduced with a rongeur, (B) Mucosal edges on the ridge are freshened, and flaps are raised. A periosteal elevator raises the palatal mucoperiosteum so that approximation of mucosal edges is made possible, (C) Flaps are sutured. Healing should take place by primary intention. The palatal wound is left open

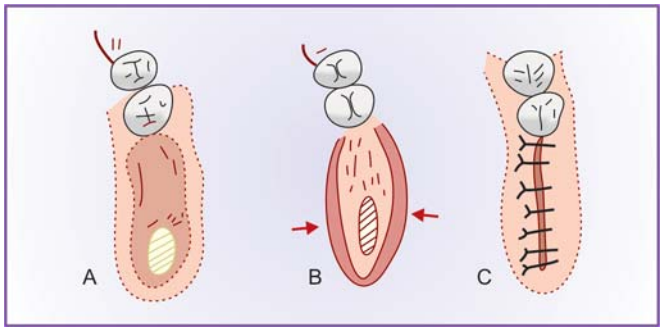


Fig. 11.5: (A) Sinus opening immediately after extraction, (B) Reduction of buccal and lingual walls to allow coaptation of buccal and lingual soft tissue flaps. The soft tissue flaps are trimmed conservatively to form a somewhat even line (C) Flaps sutured

Oroantral communication	*Oroantral fistula*
Formation, during extraction of upper posterior teeth following application of beak of the forceps, during apical thrust. Tooth may push or intrude within socket.	A tract lined by unhealthy granulation tissue between the oral cavity and antral cavity is known as oroantral fistula.
During removal of the displaced root stumps of posterior tooth closer or near to the antral cavity, leads to oroantral communication.	Untreated oroantral communication leads to oroantral fistula.
Fracture of thin bony floor and subsequent tear of the antral lining causes oroantral communication.	More than 72 hours oroantral communication consider as oroantral fistula.

After obtaining the local anesthesia the steps of surgical procedures are as follows:

Steps:

A. Excise the fistulous tract, easiest with a No 11 blade.
B. Outline (dashed) of incision for a full thickness mucoperiosteal buccal flap.
C. Reflect full thickness mucoperiosteal flap and incise the periosteal layer only. This makes it possible to mobilize the flap.
D. 'Stretch' the flap to assess the degree of elasticity once the restraining effect of the periosteum is lost.
E. The flap is advanced across the fistula and sutured to palatal mucosa over palatal bone.

After obtaining the local anesthesia the following are steps of operative procedure:

A. Excise fistula, outline palatal flap based on greater palatine artery.
B. Mobilize and rotate palatal flap, suturing its leading edge to buccal mucosa over bone, donor site to granulate under surgical dressing or pack. This procedure does not effect the buccal vestibular height palatal rotational advancement flap provides adequate mobility and tissue bulk to the flap. It requires the mobilization of large amount of palatal tissue, and may causes kin kin of the rotation of the flap, which may predispose to venous congestion. Phillip Earle Williams suggested a 'V'-shaped excision of the lesser

curvature of the flap to minimize folding—cited from Gustav Kruger.

All these methods have advantages and disadvantages too. To overcome the disadvantages of these various procedures Teruo Ito and Hironobu Hara of Nagasaki University of Japan recommended a technique using the connective tissue under the palatal mucosa for the close or repair of oroantral fistula (Figs 11.6 and 11.7).

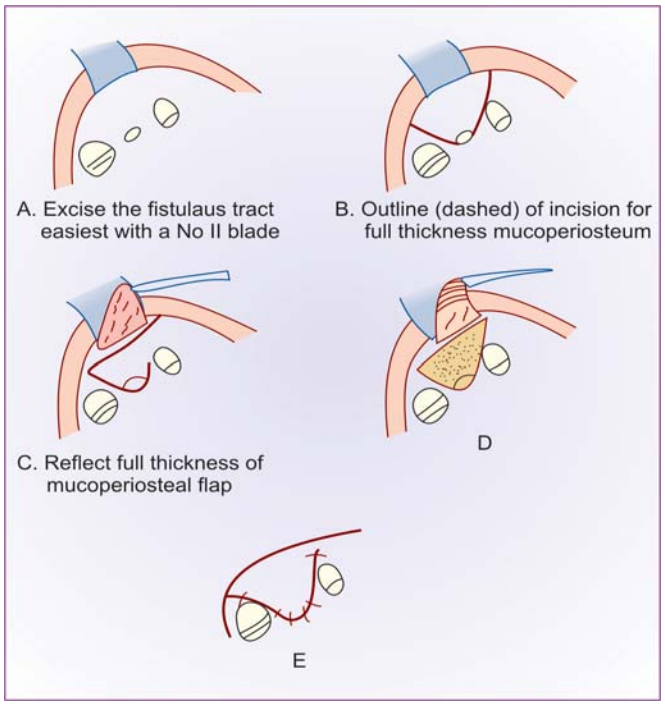


Fig. 11.6: The repair or closure of oroantral fistula by buccal advancement flap modified by Rehrmann flap by Nicholas or Y–V flap procedure—from Harris and Seward

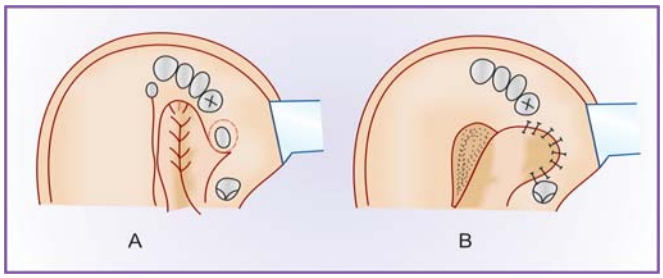


Fig. 11.7: Closure of oroantral fistula by palatal rotation flap originally described by Ashley and Berger in the year 1939

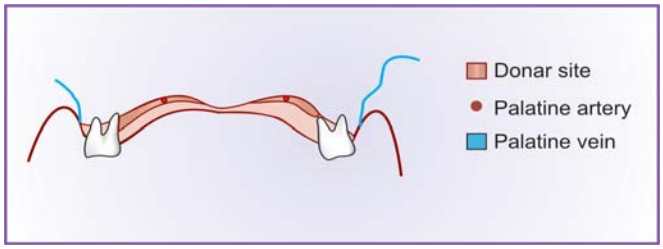


Fig. 11.8: Coronal view of palatal region

Recommended Surgical Technique by Ito and Hara

The palatal mucosa is thin in the median region, it increases its thickness as it approaches the alveolar process, and is relatively thick even at the alveolar margin. Moreover, these tissues contain the largest of the branches of the palatine artery, which runs anteriorly along the basal part of the alveolar process through the exterior alveolar groove. Because of these conditions, the submucosal connective tissue in this area can be used as a pedicle flap (Figs 11.8 and 11.9).

In this procedure, a full thickness of the palatal mucosa is incised and separated into a mucosal layer and an underlying connective tissue layer, and the submucosal connective tissue flap is used to close the oroantral fistula.

The initial palatal flap is made leaving a width of gingiva between the flap and the fistula, as indicated by the shaded area in Figure 11.10.

This is done to prevent necrosis of the alveolar margin and gingival recession. The edges about the periphery of the fistula are then freshened. After elevating the full-thickness palatal flap to the posterior area of the fistula, the flap is divided into the mucosal

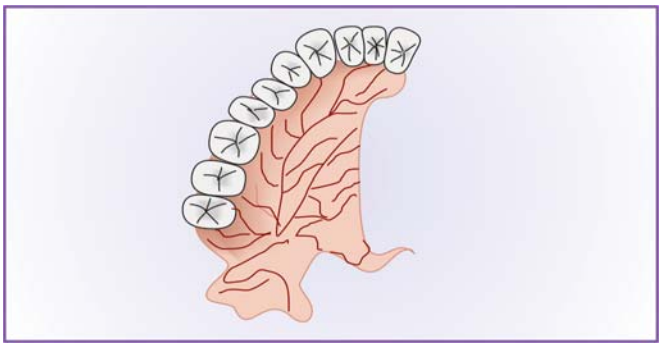


Fig. 11.9: Distribution of arteries in palate

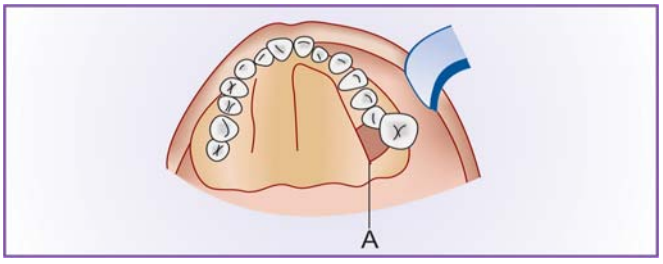


Fig. 11.10: Incision of palatal flap (A)

upper layer and the underlying layer of connective tissue, without injury to the blood vessels, so as to form a connective tissue flap (Fig. 11.11). Because the palatal mucosa near the median line is too thin to be dissected into two layers (as shown in Fig. 11.8), only the lateral half to two-thirds of the flap is dissected into two layers (Fig. 11.11). As this flap is elastic and flexible, it can be readily adjusted in width and length so as to close even a fistula of considerable size in the alveolar ridge and maxillary vestibule.

Next, the mucoperiosteum between the palatal flap and the fistula (Fig. 11.11, shaded area) is elevated to form a tunnel for passage of the pedicle flap (Fig. 11.12). The pedicle flap is then rotated under the mucoperiosteum and across the oroantral fistula (Fig. 11.13). This ensures a good supply of blood to the surgical area and allows for stable placement of the pedicle flap with minimal tension. When the attached gingiva of the recipient site is thick, it is incised to allow insertion of the pedicle flap. Otherwise, the entire mucoperiosteum is elevated and the tip of the flap is pushed under the periosteum and sutured. The primary flap is then returned to its original position and sutured to obtain primary closure. Consequently, the bone of the donor site is not left exposed. Figure 11.14 is illustrating the lateral view of the region of the closed fistula.

After suturing is completed, it is followed by the placement of a surgical stent to protect the wound surface. The stent is removed after seven days. The clinical appearance a month postoperatively. The pedicle flap is epithelialized and the fistula is completely closed.

Ito and Hara's (1980) procedures to close an oroantral fistula using a connective tissue flap under the palatal mucosa is applicable to a tissue defect in the alveolar ridge and the maxillary vestibule. Moreover, this connective tissue flap is rich in blood and is extremely elastic, and it can be easily rotated without producing a *"dog ear"*, as in the whole-layer palatal pedicle flap procedure. Stable placement in the specified position is also obtainable without excessive tension. The bone surface in the donor site does not remain exposed because the epithelial layer of the palatal mucosa is returned to the original position. Moreover, the attached gingiva in the buccal site can be maintained at an appropriate height without obliteration of the vestibule.

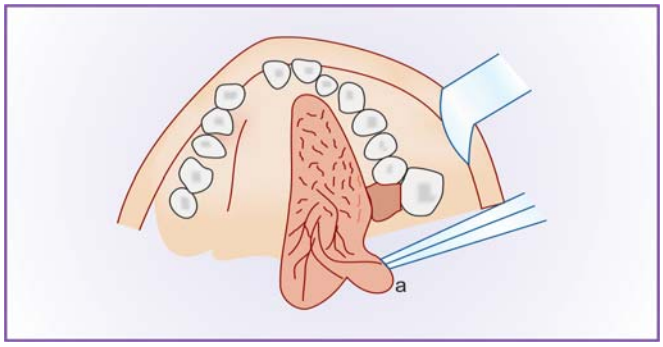


Fig. 11.11: Formation of submucosal connective tissue pedicle flap (a)

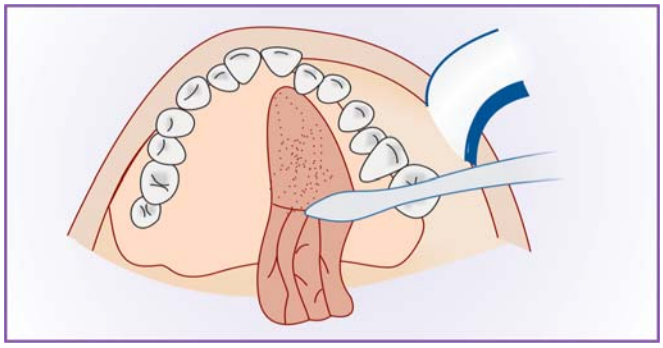


Fig. 11.12: Formation of tunnel for passage of palatal flap

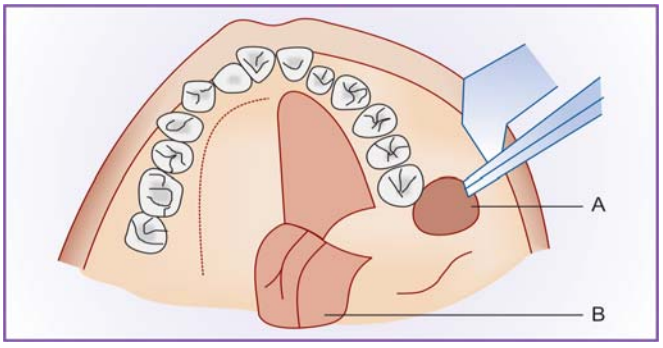
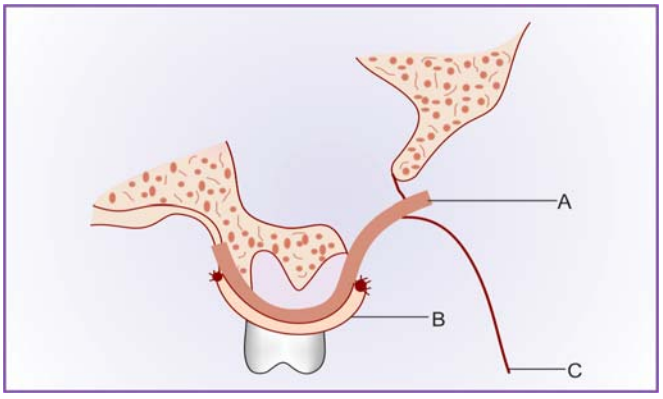


Fig. 11.13: Closure of oroantral fistula with submucoasl connective tissue pedicle flap, (A) Tip of submucosal flap, (B) Primary flap



Figs 11.14: Coronal view of fistula closure, (A) Palatal connective tissue pedicle flap, (B) Gingiva, (C) Buccal mucosa

This technique gives the patient minimal discomfort, provides early healing of the wound, and leaves no aesthetic disturbance.

Analytical observation and the present author in the Ito and Hara technique of repair of oroantral fistula, the critical step or phase of surgical procedure is the slicing of the palatal flap into submucosal connective tissue and the mucosal layer. This can be done by the Von Graefe and Berr Cataract Knife used is eye surgery.

The various methods recommended for repair of OAC and OAF from time to time starting from the Proctor operation where a cone-shaped piece of cartilage was inserted into the defect, and other alloplastic materials and metals used with limitation and of little or a questionable value. The combination of the above mentioned techniques as well as a slightly-modified reoriented improvised and altered method used by various surgeons which includes palatal transposition and rotation flap in edentulous maxilla. But one technique that should be mentioned is—'buccal fat pad transferred' procedure.

Buccal Fat Pad Transfer Surgical Procedure

This is an excellent reserve reconstruction for OAFs, which have been subject to difficult or repeated attempts at closure. The fat pad is easy to find but mobilization should be done with care to preserve bulk and to avoid the pterygoid venous plexus of veins. It can then be sutured into position. The fat pad becomes covered by oral mucosa by seeding of oral squames and growth from the margins.

Intranasal Antrostomy

1. This procedure facilitates the drainage occasionally at the end of operation to close an oroantral fistula.
2. Removed a tooth or a root from sinus (rarely). The ENT surgeon mostly uses it.

Caldwell–Luc Approach

George Caldwell, an American surgeon and *Henri Luc* of France reported this procedure to gaining access into the maxillary air sinus via the canine fossa. This procedure is used for removal of root fragments, teeth or foreign body, an antral stone or antrolith or polyp from the maxillary sinus to reduce hematoma from the maxillary sinus and to control post-traumatic bleeding in the sinus. This procedure is also used for removal of an impacted canine and third molar. This access technique to the maxillary air sinus also helps in performing transantral ligation and Blom maxillary peripherial neurectomy for the treatment of PTN.

Postsurgical prescription, instruction and advice:

1. Select suitable antibiotics.
2. Suitable analgesic for relief of pain.
3. Nasal decongestant (mentioned earlier).
4. Instructions (earlier mentioned in this chapter).

Cyst of the maxillary air sinus is discussed in the chapter of cyst. Regarding the malignant tumor of the maxillary antrum, the clinical features mentioned in the oral cancer chapter as per collaborating to the maxillary air sinus in addition to the following features.

1. Extraoral swelling of the infraorbital margin lifting the nasolabial fold with blood stained purulent discharge of the affected side of the nose with bad smell and haziness and opacity of the affected antrum. Infra-orbital nerve paresthesia and anesthesia may present with heaviness of the antral region.
2. Late features are a nasal obstruction, discharges and epistaxis the anterior spread leads to swelling of the check and face inferior spread causes expansion of the alveolar bone with pain, loosening of the teeth, poor fitting of dentures, ulceration of the palatal mucosa with expansion of the hard palate. Superior spread invades the orbit causing proptosis, double vision, ocular pain and epiphora. Posterior spread causes the involvement of pterygomaxillary fossa, pterygoid plates and the muscles causing trismus. Growth may also spread to the nasopharynx (Trotter's syndrome) and sphenoidal sinus.
3. *Diagnosis*:
   a. *Radiograph of sinuses*: Opacity of the involved sinus with expansion and destruction of the bony wall.
   b. *CT Scan*: If available, this is the best non-invasive method to find the extent of disease. CT scan should be done both in axial and coronal planes. It also helps in the staging of disease.
   c. *Biopsy*: If growth presents in the nose or mouth, a biopsy can be easily taken. In early cases, with suspicion of malignancy, sinus should be explored by Caldwell-Luc operation. Direct visualization of the site of tumor in the sinus also helps in staging of the tumor.

d. *Sinus endoscopy* of the nose and maxillary sinus will provide detailed examination.

Classification of Malignant Tumor of Maxillary Sinus (Maxillary CA).

a. *Ohngren's classification*: An imaginary plane is drawn, extending between medial canthus of eye and angle of the mandible. Growths situated above the plane (supra structural) have a poorer prognosis than those below it that means intra-structural.

b. AJCC (American Joint Committee of Cancer Classification 1977) classified malignant tumor of squamous cell carcinoma by staging of cancer involving the maxillary sinus.
   - T_1 : Tumor limited to the antral mucosa with no erosion or destruction of bone.
   - T_2 : Tumor causing bone erosion and destruction except posterior antral wall including extension into the hard palate and or medial meatus of nose.
   - T_3 : Tumor involving any of the following bones of the posterior wall of the maxillary sinus of cheek or medial wall of the infratemporal fossa, pterygoid plates and ethmoid sinuses.
   - T_4 : Tumor invades orbital contents beyond the floor or medial wall including any of the following, orbital apex, cribriform plate, bone and skin, sphenoidal and frontal air sinuses.

c. Lederman's classification uses two horizontal lines of Sebileau one passing via floor of orbits and other the through the floor of the antrum, thus dividing the area into three:
   i. *Suprastructure:* Ethmoid, sphenoid and frontal sinuses and the olfactory area of nose.
   ii. *Medial structure:* Maxillary sinus and the respiratory part of nose.
   iii. *Infrastructure:* Containing alveolar process. This classification further uses vertical lines, extending down the medial wall of orbit to separate ethmoid sinuses and nasal fossa from the maxillary sinuses.

Treatment

Includes surgery, radiotherapy and combination of both.

Jackson and Callon Fort 1996 recommended a guideline for surgical intervention of the maxilla depending on the prospective of anatomical extents in case of malignant tumor.

1. MT confined to maxilla without involvement of orbital floor. Surgical modalities subtotal maxillectomy.
2. MT involving the orbital floor without involving the peri orbital area, surgical modalities total maxillectomy.
3. MT involving the orbital contents surgical modalities total maxillectomy with orbital exenteration.
4. MT involving skull base—neurosurgical domain.

Commonly used incision in maxillary surgery is the classic Weber – Fergusson incision. It may be modified by a lip—split for better cosmetic results in addition to the intraoral incision is which is necessary for the exposure of the tumor.

The reconstruction and prosthesis for rehabilitation is mandatory for function and some extent, aesthetic.

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TWELVE

Surgical Endodontics

• Apicoectomy • Indications • Assessment • Techniques • Types of Incisions • Tit-Bits about Root Hemisection • Endodontic (Diodontic) Implants Removal of Extruded Endodontic Paste

INTRODUCTION

Disease of the pulp, periapical tissues, and their treatment are called endodontics. Infection of the pulp is known as pulpitis. The pulp can be infected through dentinal tubules (caries), a trauma, through lateral canals (deep periodontal pockets), or through blood stream (anachoresis). Dental caries is the commonest cause of pulpitis. Acidogenic bacteria demineralize the tubule walls followed by proteolysis of the matrix by proteolytic bacteria. If caries is not treated pulp is eventually infected Pulpitis may acute or chronic, depending on the duration and severity of the symptoms. Because the pulp tissues are enclosed in calcified tissue, inflammation and tissue pressure may cause greater problems than those occurring in tissues where expansion is possible. The type of bacteria found in infected pulp and root canals, mainly depend on the route by which the bacteria gain access to pulp. In open lesions, many species of bacteria can be found. As the pulp becomes necrotic, more anaerobes are found. When bacteria reach the root canal, inflammation of the periapical tissues (apical periodontitis) develops. Commonest bacteria found in these infections are anaerobes, such as *Prevotella, Parphyromonas,* Peptostreptococci and *Streptococcus anginosus* (previously called *S. milleri*), *Fusobacterium* and viridans streptococci. The microorganisms are in a low state of metabolic activity making them less sensitive to antimicrobial agents. Apical periodontitis is usually chronic because the host defense mechanism cannot reach the site. As a result, there can be several complications such as abscess formation, osteomyelitis, metastatic infection.

The treatment of infected root canals involves the removal of infected and dead tissues both mechanically and by irrigation, sometimes accompanied by the use of antibiotics and other antimicrobial agents. Usually, before the root canals are filled and restored, canals are sampled for sterility. It has been argued that it is impossible to be certain of the complete eradication of bacteria from all the tubules. Therefore, it is not necessary to culture each root canal. However, the majority of dental institutions suggest routine culturing of root canals for undergraduates as an indication of the success of their as aseptic techniques.

The surgical endodontics means the various methods of surgeries of the soft tissue within the tooth (pulp) and tooth apex and it surroundings. Inflammation and the septic necrosis and subsequent gangrene of the dental pulp as a result of carious lesion and trauma. This infected necrotic pulp subsequently reaches the tooth apex and form the periapical pathology. The treatment of above-mentioned pathology the following surgical modalities are recommended.

Apicoectomy is the surgical removal of the periapical pathology and removal of one-third of the root apex and subsequent root canal treatment and sealing by orthograde or retrograde method.

Indications

1. Failure of conventional endodontic therapy to eliminate apical infection.
2. Pathological change at the apex of a previously root filled tooth, e.g. granuloma or cyst.
3. Failure during root canal treatment, e.g. overfilling, instrument fracture, lateral perforation.
4. Root unapproachable by conventional orthograde route, e.g. post-crowned tooth, calcified root canal.
5. Anatomical variations preclude normal endodontic therapy.

Contraindications

1. Presence of systemic diseases.
2. Tooth with deep periodontal pockets with degree 3 mobility and existing alveolar bone loss.
3. Tooth having short root length.

4. Tooth damage beyond restoration.
5. Tooth root close to the nerve.

Recommended Procedures

1. Root canal treatment with immediate apicectomy and curettage.
2. Root canal treatment is done before followed by apicoectomy and curettage.
3. The periapical lesion initially treated by root canal treatment and draining via the canal. This may need the surgical intervention with root amputation and curettage in future.

The various incisions and flap design are recommended from time to time by various authorities, which are as follows:

1. Full mucoperiosteal flap may be as follows:
   a. Triangular flap.
   b. Rectangular flap.
   c. Trapezoidal flap.
   d. Horizontal flap.
2. The limited mucoperiosteal flap:
   a. Semilunar flap.
   b. Submarginal rectangular flap (Luebke-Ochsenbein).

Assessment by intraoral X-ray: Clinical examination with detailed study of X-ray reading is mandatory prior to surgical procedures. Tooth colour, mobility, extension of the fracture or injuries and periapical pathology and supporting conditions of the PDL, lamina dura and alveolar bone should be considered prior to treatment planning.

Steps of Surgical Procedures (Figs 12.1 to 12.5)

Obtained Local Anesthesia

1. *Incision and access flap*: A mucoperiosteal flap is raised. A triangular flap is preferred, and careful repositioning and suturing minimizes postoperative recession.
2. *Apical curettage*: Any apical cystic tissue, granulation tissue or infection resulting from failed root canal therapy should be curetted and sent for histological assessment.
3. *Apicoectomy*: Section of the root apex with a slight anterior bevel to facilitate visualization of the root canal. In deciding how much apex to remove, several factors should be considered:

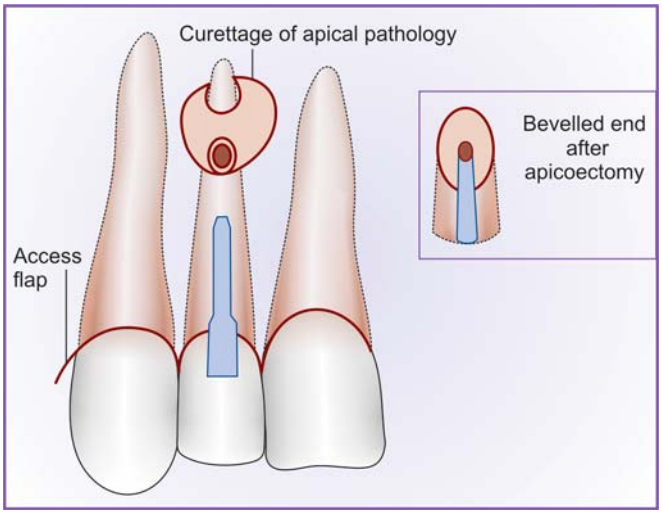

Fig. 12.1: Apicoectomy of max. lat incisor

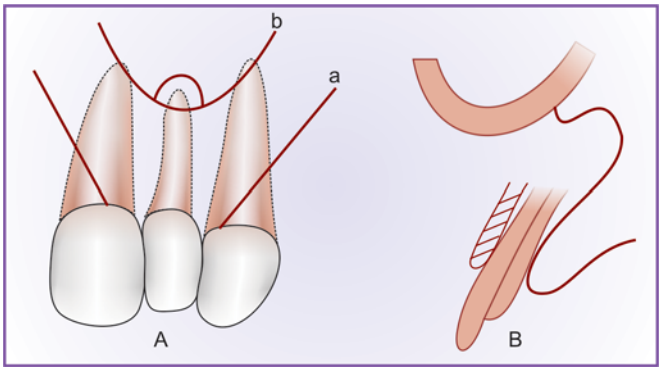

Fig. 12.2:
(A) An approach to apicoectomy
   a. Outline of incision for 3-sided flap, good access best flap for the novice.
   b. Outline of semilunar flap incision.
(B) An approach to apicoectomy, a window is created in the buccal cortex to expose the apex, which is resected, leaving a smooth raw bony cavity (Cited from Prof JR Moore, 1976)

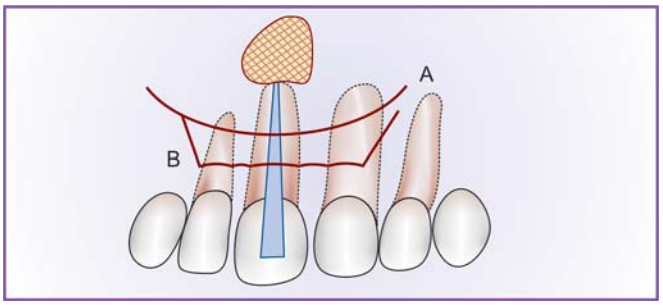

Fig. 12.3: (A) Semilunar incision (submarginal)
(B) Submarginal rectangular incision (Luebke-Ochsenbein)

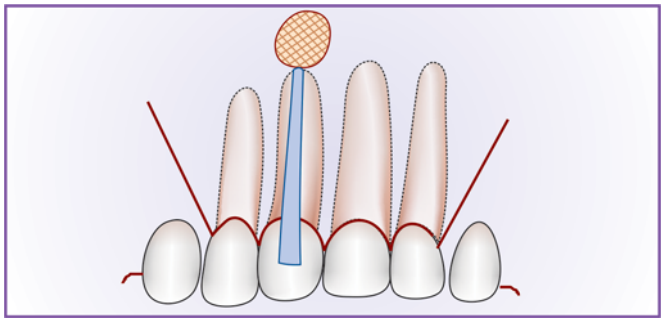

Fig. 12.4: Trapezoidal incision and flap design

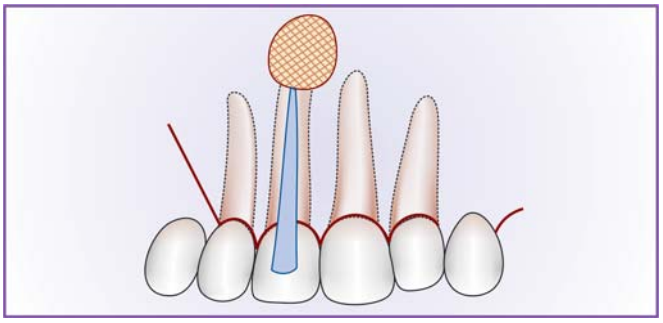

Fig. 12.5: Triangular flap incision and flap design

a. As much root as possible should remain to deal with occlusal loads.
b. Apical root (with the most potential for lateral canals) should be removed.
c. Plan the root surgery to take account of the extent of apical pathology.
d. Try not to remove so much apex as to expose any restorative post within the canal.

4. *Retrograde root filling*: Where the apical seal is deficient, a cavity should be prepared in the root tip with a microdrill. Great care is needed, and the use of magnifying loupes is advised. A suitable cement, e.g. EBA (orthoethoxybenzoic acid), is used as a filling material.

Analytical Observation

The above-mentioned method parenting to the anterior teeth. Now-a-days the apicoectomy of premolars and molars are also routinely operated. The care should be taken in case of upper posterior teeth for close proximity of the maxillary air sinus during the preparation of window at the buccal or palatal surface.

In case of lower tooth the close proximity of the inferior dental nerve and mental nerve must notated by the operator. The success rate of anterior teeth apicoectomy is much more than the posterior teeth because of the limited visual and mechanical access of the operative procedure.

Control of bleeding during surgical procedure the following measures is routinely in practice.

1. The pressure packs in the form of cotton and gauge.
2. Use of vasoconstrictors drugs. Epinephrine 1:1000.
3. Calcium sulfate.
4. Gel foam.
5. Oxidize cellulose.
6. Horsley bone wax (yellow bees wax 7 parts, olive oil 2 parts, phenol 1 part).
7. Recently Abseal also used (Ethicon Limited) to control bleeding.

Root perforations: This can be attempted surgically or by a combined approach; orthograde root filling through perforation then immediately trimming surgically.

Root hemisection: This simply involves raising a flap around the tooth, identifying and horizontally sectioning the root and atraumatically elevating it out. The wound is closed and a cleanable undersurface sealed with amalgam left.

Periapical curettage: Similar to apicectomy except leaves root apex intact.

'Through and through' root filling: Combined orthograde root filling with periapical curettage, useful in lower incisions.

Reimplantation of teeth: Replacement of tooth in socket after trauma. Light splinting is required for one week and conventional root treatment required. Complicated by root resorption.

Transplantation of teeth: One tooth (immature) transplanted into a socket of another; fairly unsuccessful; often results in root resorption.

Incision and drainage of endodontically-associated swellings sound treatment for dental abscesses. Immediate relief of patient's symptoms.

Endodontic (diodontic) implants have not received widespread acceptance. They can be used to secure an anterior tooth, which lacks sufficient supporting bone after endodontics treatment. The implant may be fabricated from Wiptam: nickel chrome wire 1.3 mm or 1.5 mm in diameter. It must be of sufficient length to extend to the original position of the tooth apex and must also penetrate at least 5 mm into the sound bone. A sterile alloy implant passes through

the prepared root canal into periapical bone and is impacted into the bone transfixing the tooth. Such implants are being superseded by single-tooth implants.

Removal of extruded paste: Usually, all that is required is an apicoectomy approach. However, careless use of 'paste only' techniques can result in paste in the floor of the nose, the antrum, or the ID canal. The nasal floor can be approached sublabially or intranasally, the antrum by standard methods and the ID canal by sagittally splitting the buccal cortex.

Analytical Observation

1. Regarding the posterior teeth apicoectomy and root canal treatment the surgical modalities almost same as above with certain deviation. The premolars and molars of the maxillary teeth the triangular and rectangular incision and flap design are the first choice. For the lower premolars and molars area the flap incision and design should be the triangular flap as because the location of mental foramen. Sometimes a release incision may be necessary distal to the second molar to reduces the tension of the flap.
2. In case of posterior endodontic surgery of the maxillary teeth careful about sinus approximation. The incision in the buccal area as well as palatal area have been discussed in the previous chapter. Sometimes the root resection of all the multirooted tooth not necessary in that case selective root resection and the RCT of the other roots along may be recommended.
3. Clinical application of guided tissue regeneration is the recent procedure in endodontic micro-surgery. The objective of GTR in endodontic microsurgery is to enhance the quality and quantity of bone regeneration in the periapical region and to accelerate bone growth in circumscribed bone cavities after endodontic surgery.

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THIRTEEN

Odontogenic and Non-odontogenic Tumors

• Excerpts of Odontogenic and Non-odontogenic Tumors • Classification • Diagnosis and Character • Radiological Appraisal and Treatment Modalities

Tumors or neoplasms are abnormal growth of the tissue in the body. They are basically divided into two separate entity (a) benign, (b) malignant. The benign jaw tumors is divided into two categories—one is odontogenic and other is non-odontogenic. The benign odontogenic tumors are neoplasms that arise from the dental lamina or any of its derivatives. In addition to their origin, they have other features in common:

1. All (some reports notwithstanding) are benigns—some (e.g., ameloblastoma) may be persistent, extremely deforming and crippling but do not metastasize.
2. With rare exception, they occur within the jaws.
3. All are slow-growing.

Oral cavity other than above lesions the following growth can be noticed. A malformation is not neoplastic growth but it may causes functional and esthetic problem because of its abnormal size or anatomical location. Hamartoma and Choristoma—When an excessive amount of normal tissue is seen in its usual location, the resulting tumor-like mass is called hamartoma. When it occurs in abnormal location it is called choristoma. Hamartoma and choristoma usually located on the dorsum of the tongue, or on the lip. The masses are circumscribed, slow-growing. Hamartoma arise before or soon after birth and grows with the patient; the swelling stops growing with the patient. They are not classified as tumors. Common examples include:

Pigmented naevi (moles): A collection of melanocytes.

Hemangiomas/lymphangiomas: A collection of blood or lymph vessels.

Odontomes: Differentiated as compound odontomes—normal relationship of enamel, dentine, cementum; and complex odontomes—diffuse masses of abnormal tooth tissue.

Benign odontogenic tumor and non-odontogenic tumors and tumor-like lesions classified by various authorities from time to time on the perspective of its origin and characteristic behaviour.

BENIGN ODONOTOGENIC AND NON-ODONTOGENIC TUMORS

Classification of Benign Odontogenic Tumor by Ivor RH Kramer, Jens J Pindborg and Mervyn Shear 1992

This classification is actually the modified and improvised version of WHO's classification of in the year 1972 by the above authorities.

A. Odontogenic Epithelium Without Odontogenic Ectomesenchyme

1. Ameloblastoma.
2. Calcifying epithelial odontogenic tumor—CEOT. Pindborg tumor.
3. Clear cell odontogenic tumor.
4. Squamous odontogenic tumor.

B. Odontogenic Epithelium With Odontogenic Ectomesenchyme, With or Without Dental Hard Tissue Formation

1. Ameloblastic fibroma.
2. Ameloblastic fibrodentinoma (dentinoma).
3. Odontoameloblastoma.
4. Adenomatoid odontogenic tumor (AOT).
5. Complex odontome.
6. Compound odontome.

C. Odontogenic Ectomesenchyme With or Without Included Odontogenic Epithelium

1. Odontogenic fibroma.
2. Myxoma (odontogenic myxoma, myxofibroma).
3. Benign cementoblastoma (true cementoma).

Classification of Odontogenic Tumor by Charls A. Waldron, 1992

A. Tumors of Odontogenic Epithelium

1. Ameloblastoma.
   a. Malignant ameloblastoma.
   b. Ameloblastic carcinoma.
2. Clear cell odontogenic carcinoma.
3. Adenomatoid odontogenic tumor.
4. Calcifying epithelial odontogenic tumor.
5. Squamous odontogenic tumor.

B. Mixed Odontogenic Tumors:

1. Ameloblastic fibroma.
2. Ameloblastic fibro-odontoma.
3. Ameloblastic fibrosarcoma.
4. Odontoameloblastoma .
5. Compound odontoma.
6. Complex odontoma.

C. Tumors of Odontogenic Ectomesenchyme:

1. Odontogenic fibroma.
2. Granular cell odontogenic tumor.
3. Odontogenic myxoma.
4. Cementoblastoma.

Analytical Observation

Waldron included AOT as epithelial odontogenic tumor but according to WHO's classification (1992) the AOT is included in the mixed odontogenic tumor.

Classification of Benign Non-odontogenic Tumor of the Jaws by Ivor RH Kramer, Jens J Pindborg and Mervyn Shear 1992

1. Osteogenic neoplasms. Cemento-ossifying fibroma.
2. Non-neoplastic bone lesions:
   a. Fibrous dysplasia of the jaws.
   b. Cemento-osseous dysplasias:
      i. Periapical cemento-osseous dysplasia.
      ii. Focal cemento-osseous dysplasia.
      iii. Florid cemento-osseous dysplasia (Gigantiform).
3. Other cemento-osseous dysplasias:
   a. Cherubism.
   b. Central giant cell granuloma.

Classification of Non-odontogenic Tumors and Fibro-osseous Lesions of the Jaw Bones

1. Non-odontogenic tumors:
   a. Central fibroma.
   b. Myxofibroma .
   c. Ossifying fibroma.
   d. Osteoma.
   e. Osteoid osteoma.
   f. Benign osteoblastoma.
   g. Chondroma.
   h. Giant cell granuloma.
   i. Central hemangioma.
   j. Benign tumors of nerve tissue (Neuroma or traumatic neuroma, neurofibroma and schwannoma or neurilemoma).
2. Fibro-osseous lesions:
   a. Fibrous dysplasia of bone.
   b. Cherubism (Inherited fibro-osseous bone disease).
   c. Ossifying fibroma.
   d. Central giant cell granuloma.

Odontogenic Tumors (Tumors Arising from Odontogenic Epithelium Without Odontogenic Ectomesenchyme)

Ameloblastoma

Ameloblastoma was described as "adamantinoma" by Brocca and Malassez in late eighteenth century. The term 'ameloblastome' was coined by Ivy and Churchill in the year 1934. Ameloblastoma is defined as, benign odontogenic neoplasm, locally-invasive epithelial tumor with strong tendency to recur. Tumor consisting of proliaferative odontogenic epithelium in a fibrous connective tissue stroma (Modified by Kramer and Pindborg, WHO 1992).

According to Willis, the ameloblastoma is considered as locally malignant. Rabinson described ameloblastoma as "usually unicentric, non-functional, intermittent in growth, anatomically-benign and clinically-persistant".

Thoma and Williams in 1993 summarized the origin of ameloblastoma as follows:

1. Late and secondary development sources.
2. Early embryonic origin.
3. Basal cells of the surface epithelium of oral mucosa.
4. The heteropic epithelium from other parts of the body, especially from the pituitary gland.

Clinical Features

Slow-growing, long duration initially symptomless, gradually increased in size. Expansion is much more than destruction. Lingual expansion is more than buccal, produced marked enlargement and deformity of the cortex of the jaw, seldom destroyed. The teeth in that area may be vital or may shows resorption.

Site

The lesion may occur in either of the jaws the mandible is affected more than maxilla, the ratio is 5:1. In mandible, usually affected areas are posterior tooth and ramus. In case of maxilla the posterior areas are involve.

Age and Sex

The age usually the second to third decades of life sometimes reported as late as seven decade. The male is slightly affected > female.

Radiological Findings (Fig. 13.1)

The unilocular (monocystic) or multilocular (multicystic) radiolucency in different forms and shape, which may be described as soap bubble or honeycomb-like appearance. The buccal and lingual cortical expansion is frequently present. Resorption of the roots of the teeth adjacent to the tumor is common. In many cases, an unerrupted tooth usually a mandibular third molar, is associated with radiolucent defect. The margins of the radiolucent zone often showing the irregular scalloping.

Histopathological Features (Fig. 13.2)

The follicular and plexiform ameloblastoma are the most common variety. The less common histopathological varieties includes the acanthomatous, granular cells, desmoplastic and basal cell types.

Follicular pattern: The most common and recognized lesion composed of small to large odontogenic epithelial nests (the folliculs) in various size and shape. The cyst formation is common.

Plexiform type: The plexiform ameloblastoma consists of long interlinking cords or larger sheets of odontogenic epithelium resembling the dental lamina.

Sub-type varities: Acanthomatous ameloblastoma showing extensive squamous metaplasia, often associated with keratin formation in the central portion of the epithelial nest or island of a follicular ameloblastoma. In that case, the term acanthomatous ameloblastoma is applied.

Granular cell pattern: The variety ameloblastomas may shows the transformation of groups of lesional epithelial cells to granular cell. These cells have abundant cytoplasm filled with eosinophilic granules that resemble lysosome ultrastructurally and histochemically. This variant has been seen in young patient and in clinically aggressive tumors. The granular cell change is extensive in an ameloblastoma, the designation of granular cell ameloblastoma is appropriate—Waldron.

Basal cell ameloblastoma is the rare type of lesion composed of nests of uniform basaloid cell, and they

Fig. 13.1: X-ray appearance of multilocular ameloblastoma of right mandible

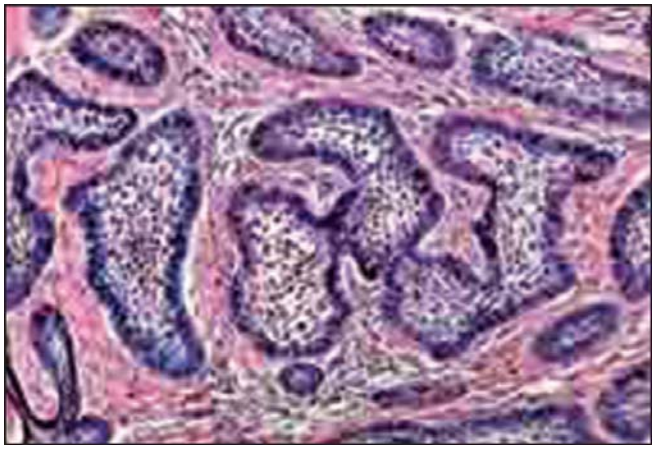


Fig. 13.2: Histological appearance of follicular type of ameloblastoma

are histopathologically very similar to basal cell carcinoma of the skin.

Desmoplastic type: A variant of solid ameloblastoma with abundant fibrous tissue stroma in the area of calcification. Presence of increased stromal desmoplasia with high recurrence rate.

Analytical Observation

1. Some authorities widely believe that ameloblastomas frequently arise in dentigerous cysts called mural ameloblastoma or some have been term as pre-ameloblastic lesion.
2. The malignant ameloblastoma and ameloblasatic carcinoma: The both lesions are controversial according to the terminology. The term malignant ameloblastoma should be used for a tumor that shows the picture histopathologically as ameloblastoma both in the primary tumor and in the metastasis deposits. The term ameloblastic carcinoma should be reserved for an ameloblastoma that has cytologic features of malignancy in the primary tumor, in a recurrence or in any metastatic deposit. This tumor having the aggressive nature and may not have metastases as a routine—Waldron.

Outline of Surgical Modalities of Jaw Tumors Including Ameloblastoma

Gold, Upton and Marx in the year 1991 standardized, different surgical methods for the lesion in bone. These are followings with slight modification:

1. Enucleation with or without curettage.
2. Marsupialization or partsh operation.
3. Resection without continuity defect also known as marginal resection (EN block resection).
4. Resection with continuity defect, (the operation for extensive lesions include the inferior border of the mandible).
5. Partial resection or peripheral ostectomy.
6. Hemimandibulectomy with removal of condylar head (disarticulation).
7. The CO_2 laser and cryotherapy has been reported in the management of ameloblastoma in small lesion.

Analytical Observation

Regarding the above treatment categorized in (7) needs time tested interpretation of the therapeutic measures and supportive documents.

Macintosh and Marx's et al 1991/93 observe ameloblastoma extents 2.3 to 8 mm its radiographic margins. The oral surgeon has recommended resecting margins should 1 to 2 cm into the normal bone. This was the original dictum of Ivor RH Kramer regarding the surgical intervention of ameloblastoma quoted from his famous article Ameloblastoma – Its Clinicopathological Appraisal. The former observers supported the view of Kramer.

Calcifying Epithelial Odontogenic Tumor (Pindborg Tumor): CEOT (Fig. 13.3)

First reported by Jens J Pindborg, a Scandnevian oral pathologist in the year 1955. It is a rare odontogenic tumor, slowly growing increasing the expansion of the jaws. Small lesions are entirely asymptomatic (Franklein and Pindborg) male and female are equally affected. Mostly occur in the molar region of the madible. Next the pre-molar region of the mandible and then molar region of the maxilla. This tumor is a painless slow-growing mass involves the adjacent structure later. The tumor is locally invasive with high recurrence rate.

Radiological Appearance

Very much characteristic:

1. A pericoronal radiolucency.
2. A pericoronal radiolucency with radio-opaque foci.
3. A mixed radiolucent and radio-opaque lesion not associated with a unerrupted tooth.
4. A 'driven snow appearance'.
5. A dense radio-opacity (occasionally) the most common are of pericoronal radio-lucency and of

Fig. 13.3: Calcifying epithelial odontogenic tumor (Right mandible). The first molar is embedded. Calcified masses are seen close to the crown of the tooth

diffuse radio-opacities within the radiolucent areas—Franklein and Pindborg 1976.

Histopathologically (Figs 13.4A and B)

CEOT has discrete islands, strands, or sheets of polyhedral epithelial cells in fibrastroma. The tumor island frequently enclose amorphous, eosinophilic hyalinized (amyloid-like) extracellular materials. The areas of calcification form concentric rings are termed as Liesgang rings.

Management

Careful excision of the tumor along with the normal margins of the bone and the soft tissue.

Squamous Odontogenic Tumor

It is a rare benign odontogenic neoplasm, was first reported by Pullon in the year 1975.

Pathogenesis or Origin of Development

It is probably arise from neoplastic transformation of epithelial cell rests of malassez within the PDL of lateral surface of erupting tooth. Histologically, it assumes as an acanthamatous ameloblastoma or well-differentiated epidermoid carcinoma. It apex male and females and the age ranges from 2nd to 6th decades of life.

Site: Maxilla and mandible both are affected equally. Usually asymptomatic lesions but sometimes causes mild pain, discomfort and mobility of the teeth.

Radiological Appearance

As a semicircular or triangular radiolucency with sclerotic or well-defined, margins may be seen associated with cervical part of the tooth.

Histopathology

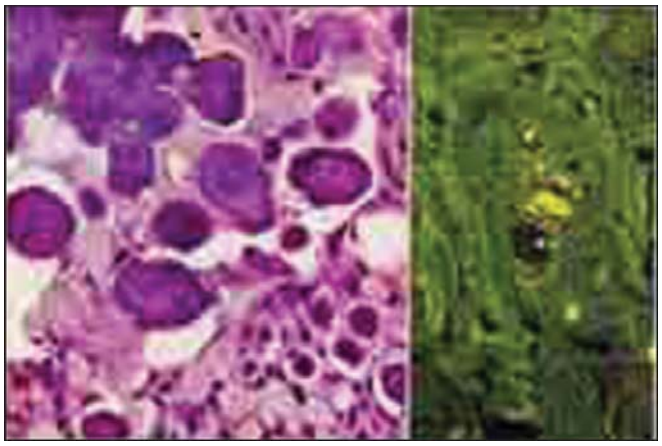
Histopathology includes various size and shape of islands of matured squamous epithelium.

Management

Conservative, local excision or peripheral osteotomy.

Clear Cell Odontogenic Tumor (CCOT)

It is a rare, benign, odontogenic central tumor locally invasive, slow-growing lesions first reported by



A B

Figs 13.4A and B: (A) Calcifying epithelial odontogenic tumor calcification in tumor tissue. (B) Calcifying epithelial odontogenic tumor fluorescence of amyloid-like material stained with thioflavine

Chales A Waldron in the year 1984. Male and female both are equally affected, commonly seen at the fifth decade of life. Mostly seen in the mandible about 75 percent of the mandible anterior region followed by the body and the angle. Rarely 25 percent seen in the maxilla.

Radiological Appearance

A unilocular and multilocular radiolucency with ill-defined irregular borders with evidence of root resorption and bony destruction.

Histopathology

Odontogenic epithelium by sheets and islands uniformly along with vacuolated and clear cells.

Management

CCOT having highly growth potentiality and local aggressiveness the radical, resection is recommended.

Adenomatoid Odontogenic Tumor (AOT)

It is an uncommon benign odontogenic non-invasive tumor. The AOT first reported by Stafne and then coined by Phlipsen and Birn in the year 1969.

Pathogenesis/Origin

Arises from residual odontogenic epithelium. Some consider as hamartomas of ROE (Residual

Odontogenic Epithelium)—Courtney et al 1975. Females are affected more than males. The youngers are affected more that means second to third decade of life. Commonly seen in the maxilla involving canine and pre-molar region. AOT is slow-growing soon infiltrating bone and inclined to displace the tooth instead of root resorption—Philipsen et al 1991.

Radiological Appearance (Figs 13.5A and B)

Well-circumscribed radiolucency or it may contain radio-opaque foci.

Histopathology (Fig. 13.6)

The lesion is well-capsulated by the fibrous tissues. The tumor is composed of duct-like structures lined by columnar or cuboidal epithelium. Sometimes the majority of the tumors are associated with impacted tooth or irregular masses of calcified materials.

Management

As the tumor is encapsulated, the conservative excision or enucleation is sufficient. The recurrence is rare and prognosis is good.

Odontoma

The tumor of odontogenic origin, composed of hard dental tissues. Tumors occur at any age and in both the sexes, affect the maxilla and mandible equally, and are usually asymptomatic non-aggressive and non-invasive in character. They are slow-growing and may persist without any symptom for decades. And it may grows for time being and then remain static for the rest of the patient's life. On the basis of radiographically and miscroscopic features two types of odontoma are recognized. One is compound odontoma and other is complex odontoma.

In the compound odontoma, crudely formed teeth on varying in size and shape may be recognized as radio-opacity in X-rays.

In the complex odontoma, the X-rays show clearly outline very dense radio-opacities. A thin radiolucent zone often surrounds these. The radio-opacity does not represent any specific shape but appears as a disorganise irregular mass.

Histopathology

The compound odontoma shows tooth-like structure consists of a central core of pulp tissue encased in a cell of dentil and covered in part by enamel.

The complex odontoma consists of haphazard conglomeration of dentil, enamel matrix, cementum and areas of pulp tissues.

Management

Since the tumors are separated from the surrounding bone by a zone of connective tissue it can be easily enucleated and removed, there is no recurrence, and prognosis is good.

Odontogenic Fibroma

Odontogenic fibroma is a central benign odontogenic neoplasm found as peripheral and central variety. Though some reported it as an uncommon, poorly-

A B

Figs 13.5A and B: (A) Adenomatoid odontogenic tumor in right maxilla associated with impacted tooth. (B) Adenomatoid odontogenic tumor associated with embedded tooth and calcified masses

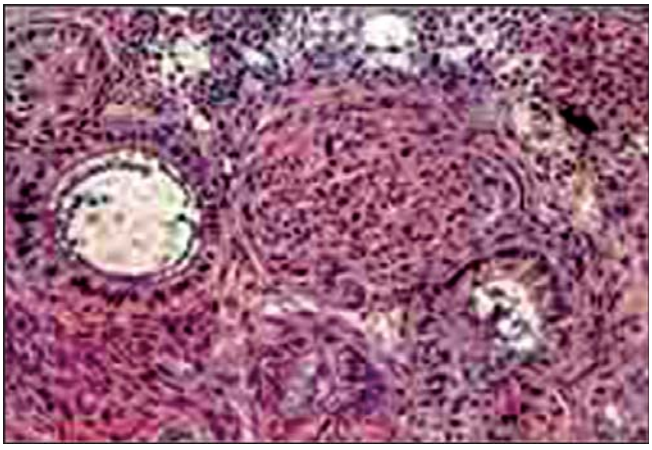


Fig. 13.6: Histopathologically shows duct-like structures in adenomatoid odontogenic tumor

understood entity but some authority consider it is as a common odontogenic tumor, but it has not been well-recognized in spite of the great frequency of the lesion. Because in X-rays it resembles or is identical to the dentigerous cyst and consequently is misdiagnosed. This odontogenic tumor occurs with equal frequency in both the sexes usually in the second decade of life. The mandible is affected more frequently than the maxilla, with the third molar and the canine areas the most common site of involving. The central lesion radiologically shows multiloculated radiolucency with well-defined scelerotic margin associated with the crown of the tooth. The lesion therefore, resembles a dentigerous cyst. At exploration of surgery, however, a solid rather than a cystic lesion is found. The peripheral odontogenic fibroma found frequently on the gingiva as pedunculated or sessile growth and normal colour of gingiva. Males and females are both affected. Usually found second to six decade of life.

Origin

The odontogenic fibroma raises from the tooth follicle that is the connective tissues that surround that enamel organ.

Histopathologically shows a circumscribed mass of dense or loosely-arranged connective tissue in which strands and islands of epithelium are dispersed. These epithelial cells do not memic ameloblasts. In some cases, they may undergo calcification, and the lesion may be called as calcifying odontogenic fibroma.

Management

As the lesion has slow growth and limited the excision and the curettage is sufficient.

Odontogenic Myxoma

Odontogenic myxoma is an infiltrative benign odontogenic neoplasm of bone that almost occurs exclusively in the jawbones. The neoplasm is mesenchymal and the myxomatous components are gelatinous in nature. Slow-growing, painless enlarging and expansion of the jaw with possible spreading, loosening and migration of teeth and roots resorption is occasionally seen. Age first to fifth decade of life. Females are less affected than the male. Site mostly in the tooth-bearing areas.

Radiological Appearance

Multiloculars small or extensive lesion. May be completely radiolucent or soap bubble, honeycomb, or tennis racket appearance with scalloped irregular margins.

Histopathology

Stellate angular or rounded mesenchymal in a homogenous mucoid stroma with few collagen fibrils.

Management

Tumor is infiltrative in nature. Excision by resection with sound bony margins. The chances of recurrence are high. Long-term follow-up is necessary.

NON-ODONTOGENIC LESIONS OF THE JAWS

Ossifying Fibroma

Ossifying fibroma is a true osteogenic benign neoplasm with a significant growth potential. This lesion previously termed as cementifying fibroma, originally derived from undifferentiated cells of the periodontal ligament.

Clinical Features

Commonly affected age is third and fourth decades of life. It is affected more female rather than male. The ratio is 5:1. It is a rare tumor. Mostly seen in the mandible premolar and the molar areas in maxilla posterior areas are affected. The neoplasm is composed of fibrous tissue that contains a variable mixture of bony trabeculae, cementum like spherules, or both. Although the lesions do contain a variety of mineralized structures, most authorities agree the same progenitor cell produces different materials. Though it is derived from the cells of periodontal ligament recently many authorities preferred to designate the cementum-like material present in ossifying fibroma as variation of bone. The designation cementifying fibroma, cemento-ossifying fibroma and cementying fibroma are all-appropriate under this tumor – Charels A Waldron cited from Neville, et al.

Radiological Appearance

Radiologically well-circumscribed tumor with sharply-demarked margins with unilocular radiolucency and with varying degree of radio-opacity.

Histopathology

Encapsulated fibrous capsule surrounding a tumor or its well-demarked neoplasm composed of fibrous tissue stroma, contains varying amount of calcifying mass resembling bone, cementum or both.

Management or Treatment

Enucleation and local resection or peripheral ostectomy. Recurrence is not reported.

Fibro-osseous Lesions of the Jaws

FOL are diverse group of processes that are characterized by replacement of normal bone by fibrous tissues containing a newly-formed mineralized product. The designation FOL is not a specific diagnosis and describes only a process. FOL of the jaws includes developmental (hamartomatous) lesions reactive or dysplastic process, and neoplasms. The histopathological features of these lesions may be similar. The final diagnosis depends on clinico-pathological and surgical appraisal.

Classification of Fibro-osseous Lesion Modified from Charles A Waldron, 1993

1. Fibrous dysplasia.
2. Cemento-osseous dysplasia (Reactive or dysplastic lesions arising in the tooth-bearing areas). These are presumably of periodontal ligament origin. It is convenient to divide them into types based on their radiologic features, although they seem to represent the same pathologic process –
   a. Focal COD,
   b. Periapical COD,
   c. Florid COD.
3. Fibro-osseous neoplasms: These are widely designated as ossifying fibroma (discussed before), cemento- ossifying fibroma.

Fibrous Dysplasia

Fibrous dysplasia is a developmental tumor-like conditions characterized by replacement of normal bone by an excessive proliferation of cellular fibrous connective tissue intermixed with irregular bony trabuculae (Fig. 13.7).

It is a sporadic condition that results from a postzygotic mutation in the GNAS-1 (Guanine Nucleotide – binding protein, ulfa-stimulating activity polypeptide gene. The fibrous dysplasia was first reported by Von Reckling Hausen in 1891. In the year 1938 Lichtenstein introduced the term fibrous-dysplasia.

Clinical and Radiological Features

Fibrous dysplasia may manifest as a localized process involving only bone called as mono-ostotic fibrous dysplasia of the jaws. When the FD involving multiple bones it is called multiostotic fibrous dysplasia. The mono-ostotic lesion is more common than the polyostotic or multiostotic. The mono-ostotic fibrous dysplasia occurs during the first or second decade of life. It is asymptomatic painless, slow-growing insidious growth. Both males and females are affected equally. Maxilla is more affected than the mandible. Maxillary lesion extends to zygoma sphenoidal floor of the orbit and maxillary air sinus and are not strictly mono-ostotic. Hence, they are called cranio-facial fibrous dysplasia. In the mandible, body is most frequently involved.

FD is unilateral, slow progressive enlargement and develops facial asymmetry, which may be the patient's chief complaint. Teeth in the involved area usually firm but may be displaced by bony mass or occlusal level can be changed. Aggressive clinical features include rapid growth pain, nasal obstruction or exophthalmos. The radiological features include ground glass appearance in mature stage due to homogenious radio-opacity with numerous trabeculae or woven bone or orange peel appearance. In early stage, some lesions may be seen as unilocular or multilocular radiolucencies and intermediate stage the radiolucent lesion intermediate with patchy, irregular

Fig. 13.7: Radiographic picture shows the ground glass appearance in fibrous dysplasia of right maxilla

opacities similar to Paget's disease. A finger print bone pattern and superior displacement of inferior dental canal may be noted.

In maxilla, increase bone density with obliteration of the maxillary sinus. In polyostotic fibrous dysplasia or Mc Cune–Albright syndrome the involvement of skull and jawbones leads to facial asymmetry.

Simultaneous of involvement of both the jaws along with involvement with other bone.

Café-au-lait pigmentation of the skin and oral mucosa with sexual precocity may be present in females is due to endocrine disturbances.

Etiology: Idiopathic (Unknown)

Several hypotheses have been postulated from time to time: (1) As a non-neoplastic hamartomatous growth resulting from altered mesenchymal cell activity or a defect in the control of bone cell activity. (2) Inherited basis. (3) Focal bone expression of a complicated endocrine disturbance (finding of estrogen receptors in an osteogenic cells of a patient).

Investigation

Ca, phosphorus and alkaline phosphatase are within normal range.

Histopathologically

Proliferating fibroblast in a compact stroma of interlacing collagen fibrous with irregular bony trabeculae may be scattered haphazardly given the picture of Chinese alphabets.

Management/Treatment

Osseous recontouring or reshaping via transoral approach to achieve esthetic and functional requirements.

Analytical Observation

Cherubism is rare developmental jaw condition that is generally inherited as a autosomal dominant trait with high penetrance but variable expressivity. The name cherubism was applied to this condition were the facial appearance is similar to that of the plump – cheeked little angles (cherubs) depicted in renaissance painting. The cherubism previously called as familial fibrous dysplasia. This term should be avoided because cherubism has no relationship to fibrous dysplasia—Waldron C. A. 1992.

Cemento-osseous Dysplasia

COD occurs in the tooth-bearing areas in the jaws and is probably the most common FOL in clinical practice. The COD arises in close approximation to the PDL and exhibit hystopathologic similarities with the structure, some investigators have suggested these lesions are PDL origin. Others believe, COD represents defect in extra-ligamentary bone remodeling that may be triggered by local factors and possibly correlated to underlying hormonal imbalance.

On the basis of clinical and radiological features they can be classified as the periapical COD, focal COD and florid COD. All these forms represent only variants of the same pathological process.

Periapical COD or Cemental Dysplasia or Cementomas

PCOD involves the periapical region of the anterior part of the mandible.

Solitary lesions may or may not with multiple foci. The females are affected more than the male ranging from 10:1 to 14:1 and approximate affected age from third to fifth decade of life.

PCOD is an asymptomatic condition. X-ray shows in early lesion osteolitic and fibroblastic stage with radiolucency in later stage matured lesion almost calcified solid homogenous radio-opacity surrounded by a thin radiolucent border.

Focal COD

The name suggests that exhibits single sight of involvement but may occur in any areas of the jaw. The posterior mandible is the pre-dominate area the disease is typically asymptomatic and detected only on radiography examination. Most lesions are smaller than 1.5 cm in diameter. Radiographically or X-ray appearance varies from completely radiolucent to densely radio-opaque with a thin periapical radiolucent rim.

Florid COD

Appears with multifocal involvement, not limited to the anterior mandible. The lesion show a marked tendency for bilateral often quite cemetric involvement with asymptomatic but patient may complaint of dull pain and an alveolar sinus tract may

be present, exposing yellowish, avascular bone to the oral cavity may present some degree of expansion. Radiologically, initially radiolucent, later become mixed that means the radio-opaque and radiolucent zone with a thin peripheral radiolucent rim. The florid COD also known as familial gigantiform cementoma or FGC. Both the dentulous and the edentulous areas are affected. The mandible is more affected than the maxilla. Many times all the four posterior quadrants may be involved.

Treatment

Most of the lesions not required any treatment following the biopsy as because the lesions are same limitative process. In case of focal COD can not be separated bone easily and is removed by curettage. The florid COD or FGC shows relatively rapid growth resulting in facial deformity. Recontouring or resaving the procedure may not help as because the rapid growth of the tissue.

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FOURTEEN

Some Soft Tissue Tumors and Central Oral Lesions or Tumors-like Growth

• Special Emphasis on Hemangioma • Histocytosis X of Interest to the Oral Surgeons

Central Giant Cell Granuloma (Giant Cell Reparative Granuloma, Osteoclast Granuloma)

A central lesion consisting of a more or less cellular fibrous tissue containing multiple foci of haemorrhage, focal aggregations of multinuclear giant cells, and sometimes trabeculae of woven bone forming within the septa of more mature fibrous tissue that may traverse the lesion. Waldron and Shafer used the term central giant cell granuloma in 1966. The central giant cell granuloma and its cystic counter part the aneurysmal bone cyst tend to occur in young patients in the second decade with a slightly increased incidence in female. The most common sight in the mandible followed by the maxilla (Salzman and Jun 1981). Jaffe's 1953 considered the lesion is dysplastic rather than neoplastic and also considered not as tumor but as reactive granuloma.

The lesion is relatively uncommon.

Based on the clinicoradiological perspective, they have been divided into two groups: non-aggressive and aggressive.

Clinical picture shows slow-growing asymptomatic swellings of the affected jaws, which fail to demonstrate the cortical perforation or root resorption, to rapidly expanding aggressive growth associated with pain, paraesthesia, occasionally resulting the ulceration of the mucosal surface.

Radiologically, there is an area of bone destruction which has a smooth or lobulated outline and which may be traversed by slender bony septa. The radiographic appearance may thus bear some similarity to that of an ameloblastoma.

Diagnosis and Histopathology

Estimation of serum Ca and serum phosphate, alkaline phophatase, and PTH are normal to confirm a diagnosis.

Histopathology is composed of a proliferation of spindled-fibroblasts in variable collagenous stroma. Multi-nucleated giant cells are present thoughout the connective tissues trauma.

Treatment

1. Corticosteroids.
2. Human calcitonin 0.5 mg (100 IU) deep subcutaneous injection for 1 year recommended by Prof. Malcolm Harris 1993.
3. Interferon alpha–2a.

Surgery

This includes curettage and enucleation.

Prognosis

It is good and low recurrence.

Brown Node or Giant Cell Lesion (Hyperparathyroidism)

It is a very rare lesion of the jaw. It affects both the mandible and the maxilla. Females are more affected than the male usually third to forth decade of life. The enlargement of the jawbones with clear-cut areas of radio lucency; teeth in the area are vital. It occurs secondary to hyper-parathyroidism, although this diagnosis is usually suggested after enucleation on finding giant cells in a fibrous stroma histologically. In the jawbones, the brown tumor of the hyperactive parathyroidism may be Histologically indistinguishable from 'giant cell (reparative) granuloma'—L.V. Ackerman.

The general systemic manifestations consist of weakness, fatigue, constipation, polydipsia, polyuria, spontaneous fractures, marked resorption of bone increased blood calcium >11 mg per 100 ml low blood

<2.5 mg per 100 ml, and increased urine calcium and phosphorus.

Treatment

Removal of disease parathyroid gland.

Central Hemangioma

Extreme rare lesion of the jaw and extremely dangerous. The mandible is affected twice as frequently as the maxilla. Slow growing and asymptomatic lesion or they may grow rapidly, expand the cortical plate, and lead to loosening of the teeth. Teeth that become loose can be "pumped" in and out of their sockets. On palpation, a pulsating thrill may be felt. The cervical area of the teeth may show oozing of the blood. This is very important to note, that the teeth on the affected area act as valve. The extraction is absolutely contraindicated, and chances of profuse intractable bleeding problems. The X-ray shows radiolucent area of honeycombed appearance. Aspiration of the lesion is a great value. Frank blood will come out.

1. Includes ECA ligation.
2. Sufficient arrangement of blood transfusion.
3. Arrangements for packing.
4. Rapid jaw resection.
5. Radiotherapy.

Treatment

Histocytosis X which includes eosinophilic granuloma, Hand-Schuller Christian disease and Letterer Siwe disease.

Eosinophilic Granuloma

Usual location, both jaws are involved; usual age, third and second decade of life. Females and males both are affected equally.

Clinical and X-ray features: Sharp clear cut areas of complete radiolucency, if around teeth, later appear to be 'hanging in air'; associated soft tissue of oral mucosa shows ulceration and necrosis; pain malaise, and other systemic symptoms; teeth in area vital.

Histological features: Histiocytes and eosinophils; and destruction of bone.

Treatment: Surgical excision and low dosage of radiation.

Prognosis: Fair to good, depending on other systemic and skeletal involvement.

Hand-Schuller Christian Disease

Usual location, both jaws are involved, children are affected more, males are affected than female.

Clinical and X-ray features same as in previous lesion.

Histological features shows histiocytes, some of which contained cholesterol and appear large and foamy.

Treatment : Symptomatic, radiation.

Prognosis: Poor.

Letterer-Siwe Disease

Usual location, mandible and maxilla both are affected. Usual age, under three years. Males and females both are affected equally.

Clinical and X-ray features: Multiple jaw radiolucencies; enlargement of spleen, liver, and lymph nodes; rapid deterioration of general health.

Histological picture shows proliferation of histiocytes.

Treatment: Symptomatic; corticosteroids.

Multiple Myeloma

Multiple myeloma is a malignant tumor of bone marrow. Patient affected about third to fourth decade of life. Males are affected twice as female. Most usually involved are the skull, jaws, vertebrae, pelvis and femur.

Clinical pictures show pain and pathological fractures, numbness, and jaw swelling, and mobility of tooth; solitary lesions may occur in jaws.

Diagnosis: Includes leukopenia means decrease WBC count. Anemia, decrease RBC count. Elevated gamma globulin, presence of Bence Jones protein in the urine (a protein in urine which coagulates between 40 to 60°C, and disappears on boiling), deposition of amyloid-like (paramyloid) material in tissues, including the gingiva, tongue and hypercalcaemia.

The mandible is involved more frequently than the maxilla, the lesions are multiple, the sites usually affected are the premolar and the molar region and the coronoid process.

X-ray shows multiple, clear cut, punched out areas of radiolucency and do not show any peripheral osteosclerotic bone reaction. Root resorption and loss of laminadura may also be seen.

Histological pictures show a solid tumor mass composed exclusively of normal and abnormal plasma cells.

Treatment: Symptomatic; surgical, radiation and massive doses of fluorides.

Prognosis is grave.

Osteosarcoma (Osteogenic Sarcoma)

A malignant tumor of the bone rarely affects the jaws, usually seen in the childhood or young adults. Males are affected more than the females. Many of the tumors developing after middle age are associated with Paget's disease. It is a highly malignant potential tumor characterized by the direct formation of bone or osteoid tissue by the tumor cells. The mandible is affected more than the maxilla. Rapidly growing tumor with the enlargement of the jaws and vague pain, and paresthsia. Often there is a history of tooth extraction or trauma. Teeth in the area may be loose and show migration and root resorption. The oral mucosa and overlying skin of the face may appear erythematous. Spontaneous pathologic fractures may occur.

X-ray shows radio-opacity in which bone trabeculae radiate from the periphery of the lesion, giving it a sun ray effect, may consist of irregular radio-opaque and radiolucent areas, or may show and almost entirely radio-lucent area. In some instances, widening of the periodontal space may be the earliest radiological sign.

Treatment includes radical resection followed by radiation therapy 5000 r is recommended or radiation prior to surgery.

Prognosis is grave.

Chondrosarcoma

It is also rare tumor of the jaws. It involves more the mandible than the maxilla and usually between 25 to 50 years of age. The clinical features of the tumor almost same as osteosarcoma but only the effect of sun ray in X-ray is usually absent. The tumor does not metastasize show readily as osteogenic sarcoma.

Treatment includes radical surgery.

Prognosis is poor.

Peripheral Giant Cell Granuloma

These are pedunculated or broad-based growth, usually have a smooth surface, are reddish-blue, and sometimes lobulated, and bleed easily. They are limited to the gingival tissue of edentulous ridges, and the mandible is involved more frequently than the maxilla. The vast majority of lesions occur after the age of 20 years, with average age of occurrence about 43 years. Males are affected slightly more often than females. Duration of the lesion is usually a few weeks to a few months. Often there is a history of trauma, such as tooth extraction.

Roentgenograms are negative, but on rare occasions, the underlying bone may show radio-lucency. Microscopic sections are diagnostic and are identical to those of a central giant cell granuloma. The tumor is made up of fibroblasts, young blood vessels, and multinucleated giant cell, and all lesions show mild to marked amounts of emosiderin.

The tumor is completely covered by stratified squamous epithelium or may be partly-ulcerated. Peripheral giant cell granuloma does not recur following local removal.

Pyogenic Granuloma

A tumor-like growth, which occurs in all ages, females are affected slightly more frequently than males. The gingival area are affected more in maxilla rather than mandible, the buccal aspect more often than the lingual aspect.

Clinically the pyogenic granuloma usually presents as an elevated, soft, pedunculated or broad-based growth, has a smooth red surface mostly ulcerated, bleeds easily, and may have a raspberry–like appearance. It has duration of weeks to month. The major mass of the growth is composed of numerous small capillaries, which are often arranged in islands and lobules and are interspersed by edematous connective tissue. The lesion shows mild to dense infiltration by polymorph nuclear, leukocytes, plasma cells, lymphocytes. The cause of pyogenic granuloma is unknown it is believed that this lesion represents and overzealous response of tissues to some local trauma.

Treatment consists of excision, by blade. Electro or cryosurgery.

Irritation Fibroma

Most common tumor-like growth of the oral cavity. Its origin is due to some local irritation. It is an elevated, pedunculated or sessile lesion which is usually firm paler in varying size and usual sites are tongue, lips, cheek and gingival tissue.

Treatment of irritation fibroma is excision, by blade—Electro or cryosurgery.

Squamous Papilloma

It is a benign soft tissue epithelial tumor of the oral cavity. It appears like white, cauliflower-like pedunculated painless growth of oral cavity. Usual sites cheek, lip, tongue commonly seen in adult both males and females are affected equally. Presumably, this lesion is induced by the human papilloma virus (HPV).

Histopathological features: The papilloma is characterized by a proliferation of keratinized stratified squamous epithelium with finger-like projections in fibrovascular connective tissue.

Treatment is excision.

Prognosis is excellent.

Lipoma

It is a rare soft adipose tissue tumor of the oral cavity. If it is seen in the mouth. The usual site is cheek. The oral lipoma is very slow-growing tumor, usually soft, smooth-surfaced nodular mass, and sessile asymptomatic in nature.

Treatment is excision and recurrence is rare.

Hemangiomas

Classically considered benign tumors of the vascular system, are now classified as hamartomas, thus denying their neoplastic nature (Andersen, 1951, Lucas, 1976). Histologically there is a proliferation of branching vascular channels wandering through a poor connective tissue stroma. Hemangiomas may be divided into several types according to the size of the vascular channels, their arrangement and the amount of the surrounding connective tissue.

Capillary type: Small blood-filled spaces, lined with a thin endothelium.

Tuberous type: Vascular dilatations having a nodular appearance.

Cavernous type: Large lacunar vascular spaces.

Over 50 percent of hemangiomas are encountered in the head and mouth area (Popescu, 1942). Very often of congenital origin (Wolfe, 1962) 85 percent of hemangiomas can be seen in new born and first year infants (Kauffman and Stout, 1963). Some hemangiomans may regress spontaneously (Tressera et al., 1977).

The tendency is explained by Longacre and Corning 1972 blood clot formation. The blood clots undergo further fibrous transformation thus producing obstruction of the vascular lumina.

Bataille et al, (1970) have observed in children that after a stationary or regression period, oral hemangiomas may develop as further growth continues. In adults their evolution is connected with masticatory trauma.

Angiography, as an investigation method for clinical study, for establishing the therapeutic indications and for the evaluation of treatment of hemangiomas (Lasjaunias and Doyon, 1982).

Treatment of hemangiomas a very large number of methods are known, modified according to the clinical condition and the site, size and structure involved. In clinical practice radiotherapy, sclerosing injections, antimetabolities, corticosteriods, cryotherapy, vascular ligation, surgical excision, laser surgery, embolisation etc. are used.

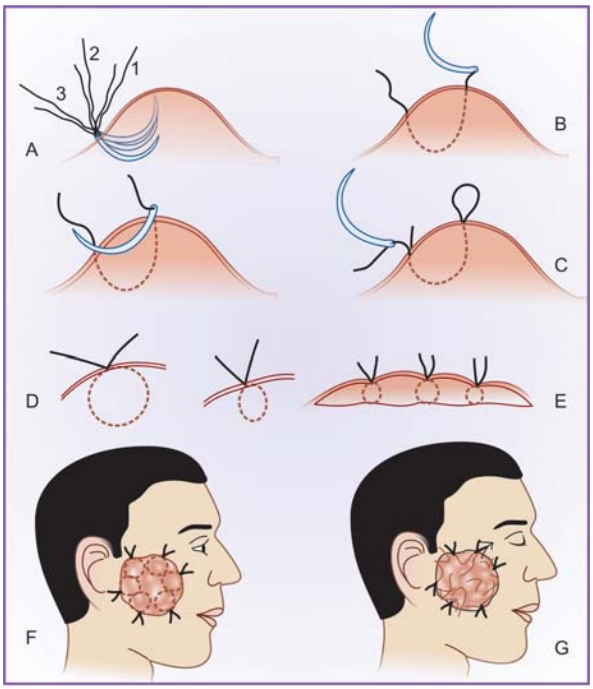
In cavernous hemangiomas sclerosing injections with Sodium Morrhuate or PEOS (Polyethyl Enoxi Sclerol) and surgery (Popescu and Stavos 1981). The intratumoral ligation the method described by Prof. Valerian Popescu in the management of orofacial cavernous hemangioma in different sites prove excellent result and follow up period of 1 to 8 years.

This method by which interception of the blood supply to the hemangioma is achieved and also break down of the angiomatous mass into segments by occlusion of vascular channels, thus completely interrupting the intra-tumoral blood flow. Obstructions of vascular lumina, endothelial atrophy, blood clot organisation in the small diverticula between them and also subsequent fibrous hyperplasia which take place of the vascular hyperplasia ensue.

General Technique for Performing Intratumoral Ligation in Hemangioma Recommended by Popescu (Figs 14.1 to 14.3)

Management and Treatment Appraisal of Hemangioma at a Glance

1. Injection scelorising sol. start with boiling water, quinine, sodium morrhuate and sodium psyllate, sodium tetradecyl sulphate.
2. Injection antimetabolite: 5 fluorcil, nitrogen mustered etc (Added risk of hemorrhage and some general site effects).
3. Corticosteroids—may cause growth disturbances and risk of malformation in children.
4. Superficial cryotherapy with CO_2 snow, can improve the facial appearance in the case of flat hemangioma.



Figs 14.1A to G: (A) The Hagedorn needle (number 7 or 8) is introduced percutaneously (or through the mucosa) by a progressive forward and rotation movement (position no. 123), a segment of the whole angiomatous mass is surrounded. (B) The needle tip is then pulled out through the skin at a point situated at 1, 5-2 cm distant from the point of penetration. (C) The thread is introduced again on a Hagedorn needle with a smaller curvature. This needle is introduced through the same point and then inserted under the skin as far as the point of entry. (D) The thread ends are tightened progressively so that the loop strangulates the surrounded segment of the angiomatous mass. (E) The threads are tightened so that the knot remains under the skin. (F) The placement of peripheral strangulating loops in a buccal hemangioma. (G) The appearance after tightening the knots, the ends remain over the skin; the blood and serum from the wound seeps out along the loops thus avoiding hemantoma formation

Fig. 14.2: Preoperative appearance at the age of 8 months prior to Popescu technique

5. Vascular ligation of E.C.A. and facial artery. This method has got limitation as because the tumor is supplied by multiple vascular sources.
6. Blade—surgical removal of small lesion. Careful about hazardous bleeding.
7. Laser surgery.
8. Embolization—various materials are used to produce both afferent vessels and vascular channels. Silicone spheres, silicone pallets, gelfoam soaked in thrombing, muscle fragments and lastly intratumoronal ligation is a new therapeutic possibility in the treatment of carvenous hemangioma.

Central Hemangioma

Extreme precaution is mandatory with microvascular surgeons and good anesthetic support with following measures:

1. Treatment includes ECA ligation.
2. Arrangement of plenty of blood transfusion.
3. Packing arrangements.
4. Rapid jaw resection.

Lymphangiomas

Lymphangiomas are benign, hamartomatous growth of lymphatic vessels. It is debatable that whether they are true neoplasm or not. They are usually representing developmental malformations that arise from sequestrations of lymphatic tissues.

Fig. 14.3: Postoperative appearance after 7 years of age following Popescu technique

There are three types of lymphangiomas:

1. Capillary lymphangioma (lymphangioma simplex), which consist of small, capillary-sized vessels.
2. Cavernous lymphangioma, which is composed of larger dilated lymphatic vessels.
3. Cystic lymphangioma (Cystic hygroma), which exhibits large, macroscopic cystic spaces.

Clinical Features

Oral lymphangiomas may occur at various sites but most frequently seen cheek and anterior 2/3rd of the tongue, which may sometimes leads to macroglossia or large tongue and may cause difficulty in phonation and deglutition. The growth is superficial soft a plebby surface looks like a cluster of translucent vesicles. Usual age child to adulthood. Male equally affected with the female. Lymphangioma may occur in conjunction with hemangioma.

Histopathologically, numerous large thin-walled spaces that contain clear homogenous lymph.

Treatment: Surgical excision.

Unfortunately, lymphangiomas do not respond to sclerosing agents as do hemangiomas. However, some success with sclerosant therapy for unresectable lymphangiomas has been reported using OK – 432, a lyophilized incubation mixture of a low-virulent strain of *Streptococcus pyogenes* with penicillin G. Potassium, which has lost its streptolysin S-producing ability.

Prognosis is good for most patients.

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FIFTEEN

Inflammation of Bone

• Periostitis • Osteitis • Osteomyelitis • Osteoradionecrosis • Paget's Disease of the Jaw Bones

Definition of Periostitis

Inflammation of periosteum (outer covering of bone). It is referred to reactive response of the periosteum, which is characterized by the deposition of new bone formation subperiosteally. This may induce osteoblastic activity of the adjacent periosteum by some unknown stimulus or by exudates, directly spreading to involve the periosteum and raising it form the cortical surface. X-ray appearance the subperiosteal new bone formation. Initially, there is a linear opacity parallel to the cortex and later a fuzzy mass, usually with a smooth lateral contour or the onion skin lamination.

Treatment

This includes identification of underlying conditions:

1. Removal of the source of infection as infected tooth or roots.
2. Drainage of pus, and
3. Suitable antibiotics.

Localized Osteitis

The localized osteitis is referred to a condition of a localized low-degree infection of bone. Example, acute alveolar osteitis sicca dolorosa (ASD) discussed in detail in other chapter.

Definition of Osteomyelitis

Osteomyelitis of the jaws is an inflammatory condition of bone which involves the medullary cavity and Haversian system of adjacent cortex. Osteogenic connective tissue dies due to deprive of its blood supply resulting pus in the cancellous spaces and/or beneath the periosteum and resulting extensive destruction of affected part of the jaw bone.

Predisposing Factors

1. When the general condition of the patient is lower or the local resistance of the bone is decreased, which may be chronic debilitating systemic disease such as diabetes, agranulocytosis, severe anemia, syphilis, tuberculosis, leukemia, extensive malnutrition and typhoid fever.
2. When the vascularity of the jaw is impaired, therefore, its ability to withstand infection include marble bone disease, long standing Paget's/ obliteration of the vascular supply of the jaw bone following radiation.

Osteomyelitis

It is divided into two varieties according to its clinical perspective:

A. Acute osteomyelitis, and
B. Chronic osteomyelitis.

Vibhagool et al. 1993 classified osteomyelitis based on the pathogenesis of alter vascular perfusion considering major contributing factors to the present and persistence of osteomyelitis as a clinical disease entity.

A – Hematogenous osteomyelitis
B – Osteomyelitis secondary to a contiguous focus of infection.
C – Osteomyelitis with or without peripheral vascular disease.

Hudson's classified osteomyelities of the jaws as follows:

Acute Forms of OML (Suppurative or Non-suppurative) Include

a. Contiguous focus:
   i. Trauma,
   ii. Surgery, and
   iii. Odontogenic infection.

b. Progressive:
   i. Burns,
   ii. Sinusitis, and
   iii. Vascular insufficiency.
c. Hematogenous (Metastatic): Developing skeleton (children).

Chronic Forms of OML

a. Recurrent multifocal OML:
   i. Developing skeleton (children),
   ii. Escalated osteogenic activity (age < 25 years).
b. Garre's OML:
   i. Unique proliferative sub-periosteal reaction,
   ii. Developing skeleton (children to young adults).
c. Suppurative or non-suppurative OML:
   i. Inadequately treated forms,
   ii. Systemically compromised forms and
   iii. Refractory forms (CROM: Chronic refractory OML).
d. Diffuse sclerosing OML:
   i. Fastidious organisms, and
   ii. Compromised host/pathogen interface.

Etiology

1. Odontogenic infection derived from pulpal or peridontium, pericoronal infection, infected tooth socket, secondarily infected cyst and tumor.
2. Traumatogenic: Specially untreated and compound fracture, surgical trauma.
3. Infection from orofacial regions originating from mucosal ulceration leads to periostitis subsequently causes osteomyelitis. Infection from lymphatic spread lacerations of the orofacial regions and quensy.
4. Blood borne infection, septicemia (later two groups very rarely affect).

Microbiological Perspective of Osteomyelitis

Majority of cases are caused by aerobic streptococci usually hemolytic streptococci, Strep *viridans* and also anaerobic streptococci and other anaerobes like peptostreptococci, fusobacteria and Bacteroides. Occasionally, anaerobic or microaerophilic cocci, gram-negative such as *Klebsiella, Pseudomonas aeruginosa* and *Proteus* are also found.

Mycobacterium tuberculosis, Treponema pallidum which causes syphilis and *Actinomyces* also produce osteomyelitis of the jaw. Actinomycoses, *Eikenella* and *Arachnia* also causes osteomyelitis of the jaws—Marx et al 1992.

Clinical and Radiological Features

Acute osteomyelitis: Fever associated with leukocytosis, lymphadenopathy less that one month in duration. Associated with soft tissue swelling of the affected region. Deep-seated throbbing continuous intense pain with intermittent paresthesia of the lower lip, which may differentiate the clinical features of acute alveolar abscess. The affected teeth are tender on percussion and showing mobility. Inability to open the mouth partially or totally (trismus).

Investigation shows elevated ESR, moderate leucocytosis, anemia and albuminuria. The radiographically, initially unremarkable or may demonstrate and ill-defined radiolucency. A fragment of necrotic bone that has separated from the adjacent vital bone is termed sequestrum. A sequestra often exhibits spontaneous exfoliation. Sometimes the fragments of necrotic bone surrounded by vital bone and this mass of non-vital bone within the vital bone is called involucrum.

Chronic osteomyelitis: When the persisting osteomyelitis is not resolved expeditiously the transformation of the acute phase to chronic variety or the process may arise primarily without a previous acute episode. Clinical features include swelling, pain, formation of discharging sinus, tooth loss or pathological fracture and ultimately the formation of sequestrum. Radiographic pictures show a patchy, ragged, ill-defined radiolucency that may contain central radio-opaque sequestra, explain as 'moth eaten appearance'.

Modified Treatment Modalities on the Basis of Guidelines Recommended by Marx and Hudson

1. *Antibiotics:* The choice of antibiotics should be based on the culture and sensitivity. Hudson 1993 personally preferred various methods to augment systemic host immune response to reach the site of infection, which includes intravenous antibiotic therapy, local implantation of antibiotics—saturated beads by Nakajima et al, 1977 and Goodell et al, 1986 and hyperberic oxygen therapy. The HBO therapy used in osteomyelitis on view of stimulation and enhances the oxygenation of

hypovascular, hypocellular and hypoxic bone tissue.
2. Disruption of infecous foci.
3. Removal of any foreign bodies, necrotic tissue with flashing with hydrogen peroxide or povidone iodine solution or metronidazole infusion may be used for irrigation of the area of infection.
4. Culture and identify specific pathogens for definitive antibiotic selection.
5. Start the empiric antibiotic based on Gram's stain.
6. Stabilize calcified tissue regionally.
7. Consider adjunctive therapy to enhance
   a. Microvascular reperfusion.
   b. Trephination (This may be performed during debridement, that is the stage 3 mentioned above).
   c. Decortication (This may be performed during the debridement process). The technique known as Mowlem's decorticotomy—described by Moor.
   d. Use of vascular flap muscles.
   e. Hyperberic oxygen therapy.
8. Reconstruction if necessary after resolution of infection.

Analytical Observation

1. Regarding the choice of antibiotic recommended Amoxycillin 500 mg 8 hourly and Flucloxacillin 200 mg 6 hourly may be preferred. In case allergic to above antibiotics sodium fusidate 500 mg 8 hourly may be used or Clindamycin 300-600 mg may be given because of ability to defuse widely in bone.
2. Present author personally experienced the use of lincomycin is one of the effective antibiotic for the treatment of osteomyelitis injection lincomycin 600 mg IM daily for one week followed by 500 mg capsule 3 to 4 times daily for another 1 week may give better result. The use of drug, care should be taken in case of renal impairment.
3. Prof William Irby incase of osteomyelitis due to *Pseudomonas aeruginosa* personally preferred injection Carbenicillin 1 to 2 gm/day in divided doses through IV route along with injection Gentamicin 80 to 120 mg per day in divided doses by IM route.
4. Chronic external sinuses may irrigate daily with Eusol (Calcium hypochlorite 1.25% and Boric acid 1.25%) or Milton's solution (stabilized 1% sodium hypochlorite solution) or Metronidazole infusion also used.

Actinomycotic Osteomyelitis of the Jaws

It is a chronic infection represent both suppuration and granulomatous features. There are varieties of actinomycotic infection of which cervicofacial variety affect mostly soft tissue overlying lower third molar of the facial structure includes tongue, parotid gland and maxillary air sinus. The actinomycotic infection of the jaws mostly caused by *Actinomyces israelii*. It is considered not as a fungi but as a gram-positive microaerophilic, nonspore bearing nonacid-fast bacteria.

Clinical Features

Soft and firm tissue mass, which have dark-red and purple with minute zone of fluctuation in oily area. Spontaneous discharge of serous yellow granules known as sulpher granules associated with fever difficulty in opening the mouth (trismus) and regional lymphadnopathy.

Radiology: Radiological appearance the area of radiolucency with varying sizes with marked sclerosis of bone. Sequestrum may or may not seen.

Diagnosis: Culture, sensitivity, and biopsy.

Culture includes aerobic/anaerobic antibody. Direct fluorescent test positive.

Closely pack branching filament 1 inch diameter (Sulphur granules)

Increased ESR and slight increase of W.B.C.

Treatment: Incision, drainage. High doses of suitable antibiotics for long duration, mentioned above.

Garre's Osteomyelitis

In some patients with osteomyelitis there is a marked growth of newborn tissue underneath the periosteom. This type of proliferative or sclerosing reaction on the periosteal site of the inflammatory lesions in bone has been called Garre's osteomyelitis. The mandible is more frequently involved than the maxilla, and the lesion occur in children or young adult. There is usually an inflammatory lesion within the jaw (example periapical abscess, radicular cyst etc.) The periosteal surface of the bone opposing the area shows marked thicking. Radio-opaque buldge of cortical surface of mandible; associated with carious tooth, usually first molar.

Microscopic show elevation of the periosteum, new bone formation as parallel traveculae of bone, fibrous marrow, and the presence of the plasma cells and lymphocytes in the marrow space.

Treatment: Extraction of offending tooth. Antibiotics, following which deformity may disappear.

Prognosis excellent.

Condensing Osteitis

Localized low-grade chronic inflammation of the bone marrow is sometimes associated with bone formation rather than with bone destruction. This productive osteitis is called sclerosing or condensing osteitis. It occurs in middle age, and the mandibular molar area is the most commonly affected site. Usually there are no symptoms. Condensing osteitis is associated with a tooth having pulp or periapical pathology or is seen in an old extraction site.

Roentgenograms show localized areas of radiopacity. Microscopic sections show dense bone trabeculae, narrow marrow spaces, and the presence of mild plasma cell and lymphocytic infiltration. The lesion does not require any treatment.

Osteoradionecrosis

ORN is the consequence of postradiation complication also known as radiation osteomyelitis. The radiation leads to hypovascular, hypocellular and hypoxic tissue with diminish capacity of normal repair. The soft tissue and its overlying mucosa may break down, leading to superficial infection of the denuded bone. ORN may develops twelve months after completion of radiation therapy, with a variation from 2 weeks to 34 months—Widemark et al, 1989.

Marx (1983) not accepting the proposed concept of ischaemic necrosis with superficial infection of the exposed bone or in other words the healing problem is essentially due to hypovascularity, hypoxia and hypocellularity. Thus, ORN of the mandible can be defined simply as exposed irradiated bone that has fail to heal over a period of three months in the absence of localized malignancy.

Clinical Features

- Asymptomatic in early stages if overlying mucosa remain intact.
- Late stage tenderness, pain and ulceration of the surface mucosa.
- Radiographic appearance shows a mixed radiolucence and radio-opaque lesion.

Investigation: Radionuclide bone scans is helpful to determining the extent of ORN.

Treatment

Prophylaxis: Prior to radiation to avoid ORN, metronidazole 400 mg 2 times a day for 7 to 10 days. Maintenance of oral hygiene. Chlorhexidine mouthwash after each meal.

Therapeutic

Includes long duration of antibiotics with or without minor surgical procedure to induce healing or mucosal cover by local intraoral flap, metronidazole 400 mg 2 times a day for 7 to 10 days.

Hyperberic oxygen therapy to promotes angiogenesis. Sometimes resection may be required.

A conservative measure may be achieved 48 percent healing in ORN by ultrasound therapy. The ultrasound programme of 1 watt/cm^2, 3 MHz, Pulsed 1:4, 15 minutes per day for 60 days recommended by M. Harris 1992.

Paget's Disease of Bone (Osteitis Deformans)

First described in UK by Sir James Paget in the year 1876. The cause of Paget's disease is unknown but inflammatory, genetic and endocrine factors may be contributing agents.

Clinical and Radiographic Features

Asymptomatic disease initially often is discovered during radiographic examination. PD may be mono-ostotic limited to one bone; most of the cases are polyostotic in nature that means more than one bone is affected. Bone pain may be severe, headache, deafness, blindness and facial paralysis associated with dizziness, weakness and mental disturbances. The frequency increases with the age, men are affected more than female. The disease principally affects fifth to sixth decades of life. The X-ray appearance shows the mixed radiolucence and radio-opaque throughout the jaw bone appears as cotton wool. The elevitated serum alkaline phosphatase about 250 BU. Incidence of osteogenic sarcoma and giant cell tumor is increased in-patient with Paget's disease.

Treatment

Anti-inflammatory analgesic helps to relieve pain frequent adjustment of new denture as because of constant bony growth of the jaws.

Early stages drug-therapy with bisphosphonates (includes etidronate, pamidronate, alendronate) in mild cases, a single infusion of a biphosphonate may present year long remissions. Plicamycin, a cytotoxic antibiotic, is known as inhibit osteclastic activity used with precaution or calcitonin to arrest osteoclastic activity.

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SIXTEEN

Various Common Sutures and Suture Technique

• Sutures • Classification of Sutures • Principle of Suturing • Knot Tying • Interrupted Suture • Continuous Suture Locking Technique • Mattress Suture • Suture Removal

The sutures are the essential part of the all-surgical modalities either primarily to repair injured wound and vessels or repair of inductive incised surgical wound.

The sutures are to hold the flap and tissue in apposition to facilitate the wound healing.

The modern sutures are prepared commercially and sterilized by gamma radiation.

Surgical silk braided black multifilament 000/00 is mostly used in oral surgical procedure. It should be remained 5 to 7 days in normal surgery but in case of oroantral fistula, it should be 14 days. The higher the number the smaller the suture size. The larger the number stronger the suture.

Requirements of suture materials it should have adequate strength with least tissue irritation and reaction, easy to handle and knotting properties with low capillarity and easy to be sterilized without deterioration.

Sutures are classified broadly into — Absorbable and non-absorbable. Absorbable means the sutures are digested by the body fluids and non-absorbable means it cannot be digested by the tissue fluids.

Absorbable sutures are:

- Plain gut,
- Chromic gut and
- Synthetic, example — Vicryl and Dexon.

Non-absorbable sutures are

- Silk,
- Synthetic, example — Nylon, Mercilene and Proline.

Other varieties of wound closure mechanical devices include Ligating clips, surgical staples and Tissue adhesives like n-butyl cyanoacrylate.

The suture needles are composed of three parts – the eye, body and the point.

The eye can be closed or swaged, and it holds the suture.

The body is the shaft section of the needle. The longitudinal shape of the body may be circle, half-circle and straight. The half-circle needles are mostly used in oral surgery.

Point is the tip of the needle, it can be cutting round or blunt. The cutting needles have at least two opposite edges. The curve cutting half-circle, Lane half inch, 5/8th circle of Dennis Brown of 22 and 25 mm. length is normally used in oral and maxillofacial surgery.

Principle of Suturing

1. The needle should pass through the tissue along its curve.
2. The needle should pass the tissue perpendicular to the tissue circle.
3. The needle should pass at an equal depth and distance from incision of both sides.
4. The needle should always passes through the thinner tissue to the thicker tissues.
5. The sutures never be closed under tension. It should not blanch.
6. The knot should be tied only approximate of the tissue and placed at a greater depth and distance from the incision.

Knot Tying

A knot can be tied using the needle holder or with the hand. The various knot includes — Square knot, Surgeon's knot and Granny's knot.

The various suturing technique available and commonly used are :

a. Interrupted suture.
b. Continuous suture.
c. Mattress suture of which may be horizontal and vertical.

Interrupted Suture

The suture is passed via the both edges at an equal depth and distance from the incision and placement of knot at one side. It is mostly used in oral and maxillofacial surgery. These are almost universal application. The wound is free of interference between each suture and it is easy to keep clean (Fig. 16.1).

Continuous Suture Locking Technique

Initially, a simple interrupted suture is placed; needle is then reintroduced in a continuous manner such that the suture passes perpendicular to the incision line below and obliquely above. Passing a knot over the untightened end of the suture finishes the suture. It provides a rapid technique for closure. This technique is explained as above in addition to providing by withdrawing the suture via its own loop to achieve locking to prevent excessive tightening of the suture as the progresses of the wound closure (Fig. 16.2).

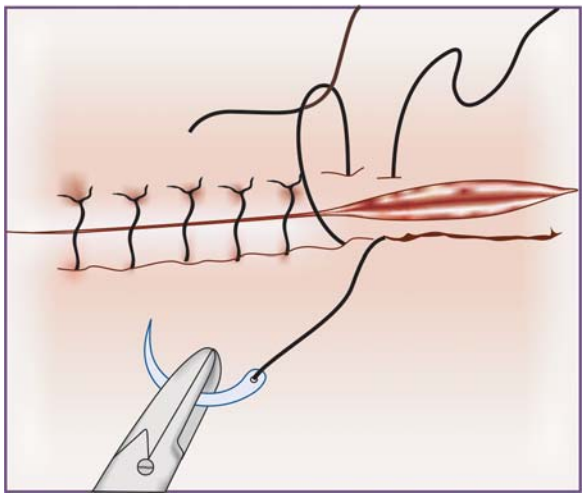

Fig. 16.1: Interrupted suture technique

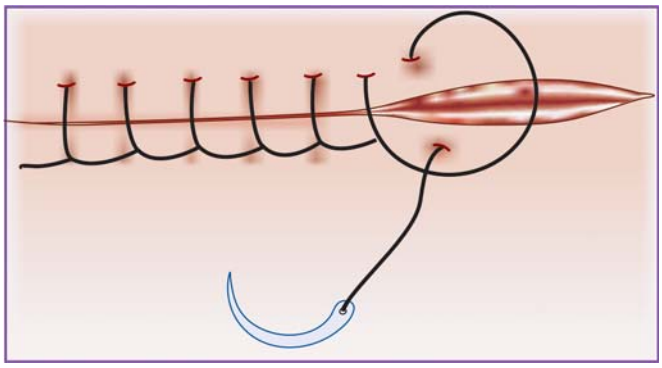

Fig. 16.2: The continuous suture locking suture

Mattress Sutures maybe Horizontal or Vertical

Horizontal mattress suture: This has the property of everting the mucosal or skin margins, thereby bringing greater areas of raw tissue into contact. For this reason it is useful for closing wounds over bony deficiencies such as oro-antral fistulae or cyst cavities (Fig. 16.3).

Vertical Mattress Suture: Specially designed for use in the skin, they pass through it at two levels, one deep to provide support and adduction of the wound surface at a depth and one superficial to drawn the edges together and evert them (Fig. 16.4).

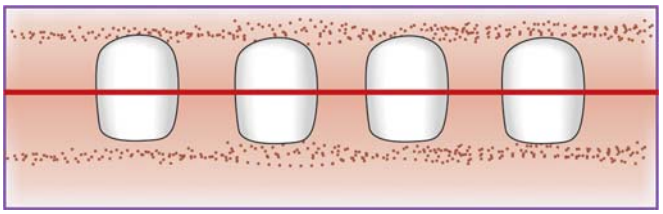

Fig. 16.3: Horizontal mattress suture

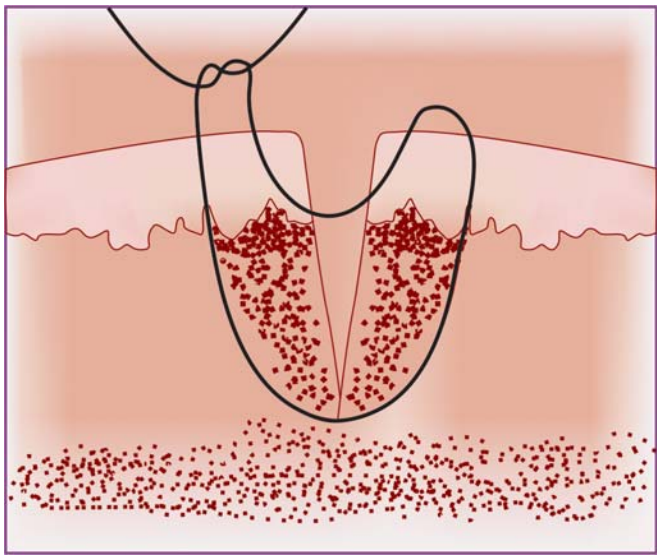

Fig. 16.4: Vertical mattress suture

Suture Removal

Normally, intraoral suture in uncomplicated cases may be removed with 5 to 7 days after placement. The suture is grasped tissue holding forceps and lifted above the surface and then suture cutting scissors passed via the pull loop and cut the thread close to the surface. Then the suture is pulled-out, and thereby prevent contamination from outer surface to the inner tissue.

Analytic Observation

1. Suture is used to repair of injured wound and vessels, and repair of incised area after surgery.
2. Suture is also used to keep the pack (White head varnish pack) inside the oral wound as called stay suture.
3. Suture is also used to keep the drainage tube in position (extraoral corrugated rubber sheth in case of draining abscess).
4. Suture is also used to hold the button in Kazanjian's operation and Clerk's technique as retraction suture. In vestibuloplasty in pre-prosthetic surgery, Hammock suture is also used (Fig. 16.5).
5. Retraction suture is used to pull the tissue for visual and mechanical access.
6. Other use includes external carotid artery ligation*, maxillary artery ligation via transantral approach, stick tie technique.
7. Distal to second molar after removal of third molar impaction an interrupted suture is mandatory to avoid any distal pocket of second molar and horizontal mattress suture is mandatory following repair of oroantral fistula.

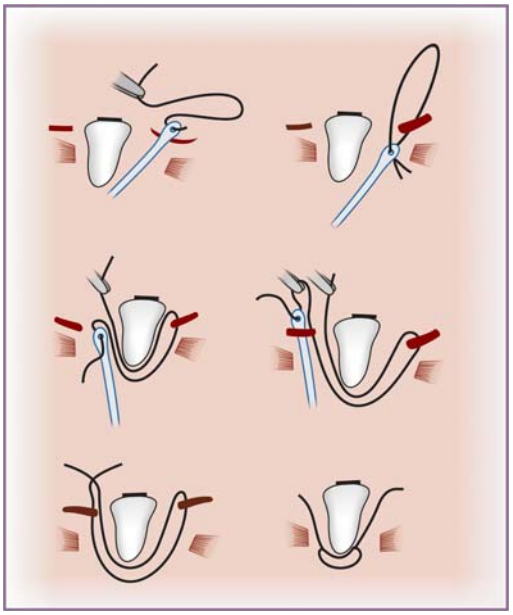

Fig. 16.5: A diagrammatic representation of the insertion of a Hammock suture. Modern absorbable suture materials mean that these no longer have to be removed. Sutures made of polyglycolic acid resorb slowly and are very strong

FURTHER READING

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SEVENTEEN

Clinical History and Examination in Oral Surgery and Some Dictum and Discipline

• Objectives of Clinical History Taking • Medical History • Surgical Dictum • Clinical Examination • Blood Examination • Urine Examination • Pus and Purulent Discharge Examination • Skin Test

The objective of clinical history taking is to achieve a correct evaluation of the patient's problems and analysis of his/her symptoms, general conditions, habits and social economic status. The enquiry into the history of the problems provides valuable clues; it is mandatory to establish the nature of the problem. Example as follows:

- Pain, discomfort or altered or abnormal feeling
- An esthetic problem
- Altered function
- Bleeding or exudates
- Lump or swelling
- Halitosis.

The above mention problems may combinely or isolatedly present. The determination based on the following:

- When the problem was first noticed?
- Is it continuous or intermittent and the frequency of attack?
- Is there any initiating or relieving factors, example hot/cold, worse on biting, worse on bending forwards?
- Exact location of the problems, example specific tooth or generalized
- The character of pain dull, sharp, throbbing, shooting, lancinating, disturbing sleep, relieved by analgesics, spread or radiated to adjacent structures or referred.

The clinical perspective helps the pre-operative assessment as follows:

a. Treatment planning that will beneficial to the patient as per age/general health condition, socio-economic status.
b. To consider the ability of the patient to with stand surgical trauma. Necessary assessment for use of proper pre-medication.
c. The choice of local anaesthesia/local anaesthesia under sedation or general anaesthesia.

Again the stages of clinical history taking denotes:

1. General information regarding the name, age, and his/her marital status, address, race, habits and occupation.
2. Chief complains:
   a. All the symptoms chronologically arrange in the patient own version.
   b. The onset duration and propagation or progress of each of the symptoms.
   c. Any treatment prior for the condition and the patient feedback if there any past history of similar episode and treatment along with the outcome.

Medical History

Medical history of the patient is important for oral surgical protocol. History of the following disease or conditions are important for further treatment modalities as follows:

a. Hypertension.
b. Bleeding disorder.
c. Rheumatic heart disease (sub-acute bacterial endocarditis) precaution is important for prior to oral surgical procedure.
d. Diabetes mellitus.
e. Liver disease manifested by jaundice.
f. Thyroid problems.
g. Pregnancy (Physiological condition).
h. Asthma.

The above mention conditions require thorough investigation, precaution and medical consultations before surgery.

The diagnostic panorama includes:

a. History and clinical examination including radiological interpretation example–I/O, Periapical, occlusal, parrllax, extraoral X-ray includes different angulation (lat. oblique), O.P.G., P.N.S View, Town's view etc.
b. Laboratory aids, example, CBC, HB percentage, ESR, BT and CT, PTT etc.
c. Biopsy includes Pap smear F.N.A.C.
d. Study model.
e. Special investigation includes CT scan, Ultrasound, MRI etc.
f. Examination under anesthesia (EUA).
g. Test block for diagnostic aid for neuralgia.

Surgical Dictum (Figs 17.1 and 17.2)

1. The incision and exposure of the operative field should provide the maximum visual and mechanical access to the surgeon's and assistant. It should be optimum neither minimum nor maximum. Mouth prop various retractors, Gag and various pull suture also provide operative access.

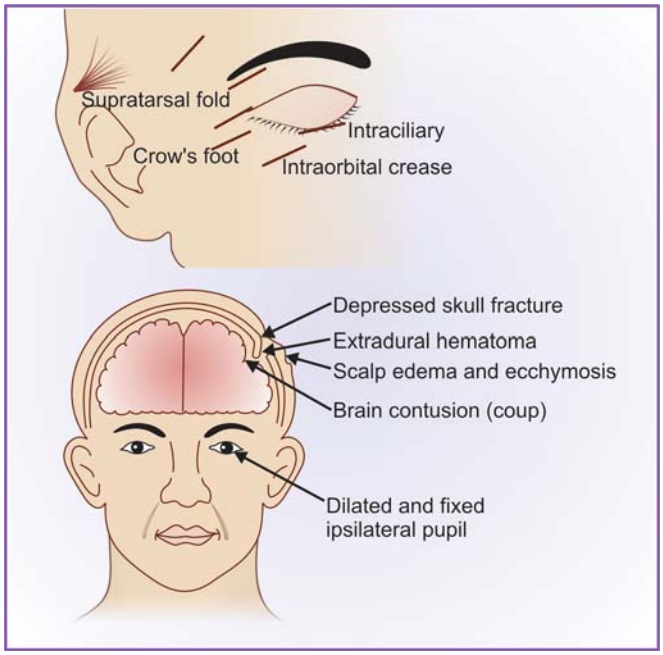

Fig. 17.1: Some of the most common incision for approaches to fracture of the middle-third of the face

The basic extraoral incision for drainage from different spaces commonly as follows:

1. Submandibular incision
2. Temporal incision
3. Submental sublingual incision.

The following incisions are mostly used in maxillofacial regions in different maxillofacial surgical procedures:

2. The exposure area should be repairable with placement of sutures with or without pack and without any discomfort and tension.
3. Maintenance of wound must be taken care of following surgery.
4. Preoperative check-up and choice of anaesthesia should be assessed within the basis of history and anesthetic consultation with chest X-ray and others relevant X-ray and laboratory findings.
5. Always reassured the patient with confidant. Apprehensive nervous patient should deal with care and sympathy but in a gentle strong manner. Otherwise, your low tone sympathetic attitude may leads to patient more nervous.
6. Do not do anything (surgical modalities) beyond your limit, if it is not feasible for your part. No harm to send the patient to the competent consultant. This is very important to avoid unnecessary problem in future.
7. If anything unto ward has happened to any patient, explained gently to the patient and if necessary accompanying person. Help as much as you can to send the patient to the proper place or give a next appointment according to the patient convenience.
8. During surgery bleeding vessels should be cauterize or ligated.
9. Prior to closing the wound care should be taken that field of operative zone almost blood free.

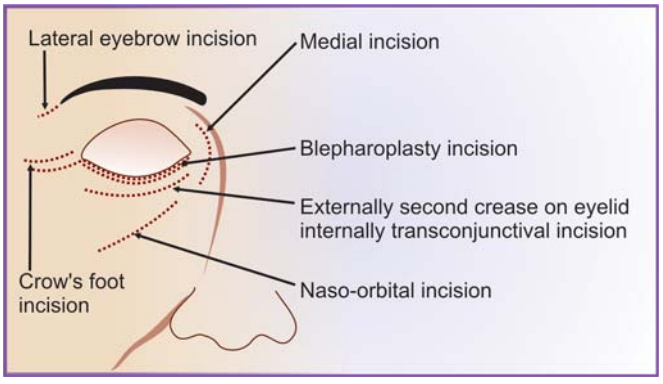

Fig. 17.2: Surgical approaches to orbit

10. Ask anesthetist frequently during the surgery about the condition of the patient or looked to the monitor (lovely).
11. Throat pack must be removed at the end of the surgery and also removed the clot and saliva by sucker. Examine the patient's mouth carefully prior to IMF in case of fracture.
12. Incision for drainage should be on the dependent part of the abscess to free flow of pus.
13. Incision as much as possible along the Langer's lines of tension preferably on skin crease to avoid scar. This is very important for esthetic viewpoint.
14. Surgeon must be careful during removal of broken needle and foreign bodies like tooth or root stump. Good light is essential particularly in this case and careful about accidental seepage of foreign bodies.
15. Incision should be made by sharp blade with a gentle continuous stroke.
16. Surgeon should be careful about vital structure and vessels during incision and should have through the epithelial surface.
17. In oral cavity the incision should be placed on healthy bone and attached mucosa.
18. The skin edges must not be suture too tightly, and suture should be removed on third or fourth day to avoid sutures scar.

Important Aspects of Anatomy Necessary for Operative Technique

Fundamentally, the major facial vessels concerned in oral surgical exposures run a course that is (1) deep to the superficial muscles of expression (including the platysma but excluding the caninus and buccinator muscles) and (2) superficial to the muscles of mastication and, of course, the deeper facial bones. In a similarly general sense, the facial vein drains areas supplied by the facial artery, and the posterior facial vein drains those deeper facial areas supplied by the terminal branches of the external carotid artery. The major sensory nerve to the face is the fifth cranial nerve. The major motor nerve to the face (other than to the muscles of mastication, which are supplied by the fifth cranial nerve) is the seventh cranial nerve. Surgical injury to the fifth cranial nerve may be considered of minor significance, since sequel to such injury most likely would be sensory paraesthesia, with good chance for regeneration. However, surgical injury to the seventh cranial nerve and subsequent loss of function of the muscles of expression presents extreme cosmetic problems, without much hope for spontaneous and functional regeneration.

Clinical Examination

Some important features of the lesions characterized as follows:

- Site or location. Shape sharpness of boundary.
- Color consistency or contour.
- Texture, mobility or fixation.
- Ulcer or erosion.
- Localized inflammation or indurations.
- Regional lymphadenopathy.
- Pulsation and fluctuation.
- Radiological changes.

Important pain character already discussed early of this chapter. The examination of *lump or swelling* must be considered for diagnosis. *The character of swelling may be tender on palpation denoting inflammatory, traumatogenic or malignancy. The non-tender swelling may be cystic, pulsatile thrill (carotid aneurysm) soft tissue growth (lipoma, papilloma) central or peripheral bony lesion.*

The characteristic of lump or examination of the facial lymph nodes in the form of cervical lymphadenopathy may be characterized by:

a. *Infection*—nodes are tender on palpation and fixed. Features of septicemia increased E.S.R. increased P.T.R. in case of tuberculosis, CHXR, mantoux test positive, increased E.S.R. positive acid fast stain of sputum;
b. *In case of malignancy*—nodes are tender palpable, matted and fixed, the oral ulcer is typical rolled out everted margin with indurations, X-ray FNAC and biopsy confirm the diagnosis;
c. *Hodgkin's disease*—nodes are palpable and rubbery.

The above-mentioned features of nodes denoting the probable path of diagnosis.

Common Investigation for Routine Practice

Examination of blood, urine, pus and culture and different skin test mostly helps in diagnosis.

Learning of normal blood physiology and chemistry is essential for practice (Tables 17.1 and 17.2).

Blood Examination

Blood examination is done to find out quantitative and qualitative abnormality of its formed elements, viz., erythrocytes, leukocytes and thrombocytes, and chemical components of blood plasma, viz., non-

Table 17.1: Physiologic norms of blood

Volume	7 to 9% body wt. (4,000 – 6,000 cc)
pH	7.35 to 7.45
Erythrocytes	4,500,000 – 5,000,000/cu mm
Leukocytes	5,000 – 9,000 cu mm
Polymorphonuclear neutrophils	60 – 70%
Lymphocytes	25 – 33%
Monocytes	2 – 6%
Eosinophils	1 – 4%
Basophils	0.25 – 0.5%
Reticulocytes	0.5 – 1.5%
Platelets	200,000 – 600,000/cu mm
Hemoglobin (average for both sexes)	14 – 15 gm/100 cc
Hematocrit (men)	38 – 48%
Hematocrit (women)	36 – 47%
Color index	0.9 – 1.1
Volume index	0.9 – 1.1
Mean corpuscular volume	80 – 94 cu U
Mean corpuscular hemoglobin	27 – 32 micro-micrograms
Mean corp.hemo.concentration	32 – 38%
Bleeding time	1 – 3 min
Coagulation time	2 – 8 min
Clot reaction time	Begins in 1 hr, complete in 24
Sedimentation rate, in 1st hr.	0 – 10 mm (men), 0 – 20 mm (women)
Prothrombin time (Quick)	10 – 15 sec

Table 17.2: Blood chemistry finding–normal and abnormal

	Minimal quantity necessary for determination	Normal range values/100 cc	Conditions in which variations from normal may occur increase	Decrease
Glucose	5 cc. Serum, oxalated whole blood or plasma 0.1 cc (micro method)	80–120 mg	Diabetes mellitus; hyperthyroidism, acromegaly; hemochromatosis; adrenal tumours, cortical or medullary	Hyperinsulinism Addison's disease, adenoma or carcinoma of islands of Langerhans
Total serum protein	5 cc serum	6.0–7. 5 Gm	Dehydration	Cachectic illnesses, renal disease, severe burns, malnutrition, liver disease
Albumin	5 cc serum	3.5–5.5 Gm	Dehydration	Renal disease, malnutrition, liver disease
Globulin	5 cc serum	2.5–3.0 Gm	Chronic infectious disease such as tuberculosis, syphilis, malaria, rheumatoid arthritis lupus erythematosus, periarteritis nodosa, kala azar, lymphogranuloma venereum, sarcoidosis, cirrhosis, myeloma, carcinomatosis	
Albumin Globulin (A/G) Ratio		1.3:1to 3:1	See albumin and globulin above	
Fibrinogen	5 cc oxalated serum	0.25–0.5 Gm	Most infectious disease, conditions producing inflammation or destruction, traumatic injuries	Liver disease, cachexias

Contd...

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Nonprotein nitrogen	5 cc serum oxalated whole blood or plasma	25-38 mg	Renal disease, urinary obstruction; cardio failure; intestinal obstruction, gastro intestinal haemorrhage; metallic poisoning, dehydration and shock	
Urea nitrogen	5 cc serum, oxalated whole blood or plasma	8-20 mg	Same as non-protein nitrogen	Severe liver damage
Creatinine	5 cc serum, oxalated whole blood or plasma	1-2 mg	Renal disease, urinary obstruction, metallic poisoning	
Uric acid	5 cc serum, oxalated whole blood or plasma	1.5-4.0 mg	Gout, nephritis, eclampsia	
Calcium	5 cc serum	9.5-11.5 mg	Hyperparathyroidism, parathyroid administration, vitamin D over dosage	Hypoparathyroidism, severe nephritis, uremia, rickets
Phosphorus (Inorganic)	5 cc serum	2.5-3.5 mg (adult) 3-5 mg (children)	Tetany, nephritis, uremia, rickets	Hyperparathyroidism
Sodium 5 cc serum		0.315-0.340 Gm		Addison's disease, severe diarrhoea, high fevers, diabetic acidosis
Potassium	5 cc serum	16-22 mg	Addison's disease	
Chlorides as NaCl	5 cc serum	0.57-0.62 gm	Nephritis, eclampsia, cardiac failure	Gastrointestinal disturbances, febrile conditions, acidosis, vomiting, shock
Cholesterol	5 cc serum	150-250 mg	Lipoid nephrosis amyloidosis, biliary cirrhosis, myxedema, obstructive jaundice, diabetes	
Cholesterol esters	5 cc serum	50.75% of total cholesterol	Obstructive jaundice	Severe liver disease
Total lipids	5 cc serum	0.57-0.82 gm	Nephrosis, diabetes, arthritis, hypothyroidism	
Serum acid	5 cc serum	1-3 King Armstrong u		
Phosphate		0-1 Bodansky u		
Serum alkaline Phosphate	5 cc serum	1-13 King Armstrong u 1-4 Bodansky u	Increased osteoblastic activity (Paget's disease, osteogenic sarcoma, osteoplastic bone metastases, rickets, hyperpara thyroidism), obstructive jaundice	
CO_2 Combining Power	5 cc serum taken under liquid petrolium	50-70 volumes/100 cc	Emphysema, chronic, vomiting, alkalosis	Acidosis, ketosis, intestinal obstruction, diarrhea, traumatic shock

protein (nitrogen components), proteins, electrolytes, inorganic components, lipids, enzymes, hormones, and vitamins.

Urine Examination

Urine examination for oral surgery, specific gravity, reaction (acidity test), Purdy's heat test for albumin, Bence-Jones protein, Benedict's qualitative test for glucose, Lange's test for acetone, bilirubin, urobilinogen, benzidine test for blood, Sulkowitch test for calcium. The pathologist can do microscopic examination of urine for presence of RBCs, WBCs, epithelial cells, casts, mucous threads, and micro-organisms.

Table 17.3: Physiologic norms of urine

Average amount in 24 hours	1,200 to 1,500 cc
Reaction of litmus	Fairy acid
Specific gravity	1,005 to 1,022
Color	Amber
Constituents (in 24-hours specimen):	
Urea	20.0 – 30.0 gm
Uric acid	0.6 – 0.75 gm
Total nitrogen	10.0 – 16.0 gm
Ammonia	0.5 – 15.0 gm
Chlorides	10.0 – 15.0 gm
Phosphate	2.0 – 4.0 gm
Total sulfur	1.0 – 3.5 gm
Creatinine	0.3 – 0.45 gm
Total solids	50.0 – 70.0 gm
Total acidity	Equiv. to 400 – 600 cc of N/10 NaOH

Pus and Purulent Exudates Examination

Pus may be collected by means of a sterile syringe and should be sent to the laboratory in a suitable plugged tube. Only in exceptional circumstances should a swab be used to collect the material. In general, the examination of pus should be by films and culture.

Skin Test

This susceptibility is indicated by an inflammatory reaction at the point of application of infection of the test substance; it may indicate normal susceptibility to toxic material, or it may indicate a state of delayed hypersensitivity or allergy to protein substance.

EIGHTEEN

Orofacial Infection and Its Spread

• Key Words • Periapical (Dental Abscess) • Periodontal Abscess • Pericoronitis • Routes of Spread of Orofacial Infection • Fascial Spaces • Facial Cellulites • Necrotizing Fasciitis • Cavernous Sinus Thrombosis • Infection of Nonodontogenic Origin

KEY WORDS

Abscess

A collection of pus in a cavity formed by disintegration of tissue as result of infection.

Infection

The communication of disease by the invasion of body tissue by specific pathogenic microorganisms.

Inflammation

The inflammation is the series of changes which occurred in the living tissue to response to the irritant, provided the irritant is not such of to kill the tissue out right.

Discharging Sinus

An unhealthy granulation tissue tract opening in one side of the single compartment (example extraoral discharging sinus).

Fistulae

An unhealthy granulation tissue tract opening in both side of two different compartment (example oroantral fistulae).

Infections of odontogenic in origin have a mixed bacteriological etiology, which includes streptococci, which may be aerobic and anaerobic, and *Bacteroides*, which are anaerobic. The majority of localized dental infections are as follows:

Periapical (Dental) Abscess

Commonest type of abscess arises from an infected pulp chamber.

Pathophysiology of odontogenic infection can be explained as: invasion of the dental pulp by bacterial infection following **dental caries of a tooth → inflammation, edema and lack of collateral blood supply → venous congestion or a vascular necrosis consequently death of the pulp → reservoir for bacterial growth → the bacteria penetrate and spreading into the surrounding bone**.

Treatment

1. Suitable antibiotics to control infection.
2. Analgesic, anti-inflammatory to relieve pain and inflammation.

Table 18.1: The differentiation of abscesses which are periapical and periodontal in origin

	Periapical (dental) abscess	*Periodontal abscess*
Pain swelling	History of toothache Over tooth apex, likely to	Acute onset Usually localized. Extraoral swelling may or may not be present
Pocket	May or may not be present	Always present, more likely in presence of periodontal disease
Sinus	Tracks to periapically	Frequently on attached gingiva
Percussion	Tooth/teeth tender on percussion (TTP) specially on axial direction	Tooth/teeth tender on percussion (TTP), worse laterally
Restoration status	More likely in heavily restored fractured crown	More likely tooth is caries-free or unrestored
Vitality	Tooth nonvital	Tooth usually vital
X-ray	Loss of lamina dura in periapical region after 10 to 14 days	Little evidence in early stages there may be bone loss

3. Periapical curettage apisectomy, R.C.T. and crown preparation if possible.
4. Otherwise remove the offending tooth and curettage of the socket and sutures.

Periodontal Abscess

An acute infection and collection of pus within a gingival or periodontal pocket.

Treatment

1. Suitable antibiotics preferably combination with metronidazole to control infection;
2. Analgesic to relieve pain;
3. Maintenance of oral hygiene by chlorhexidine mouth wash;
4. Followed by supra and subgingival curettage to remove the calculus as foreign bodies.

Pericoronitis

Define as infection under the operculum or inflammation of a surrounding soft tissue of a partially erupted tooth.

Clinical Features

Pain, swelling, difficulty in opening the mouth (trismus), difficulty in swallowing (dysphagia), regional lymph adenopathy.

Treatment

1. Primary treatment of irrigation under the operculum with hydrogen per oxide or povidone iodine solution.
2. Antibiotic, analgesic and anti-inflammatory to control spread of infection, trismus and lymph adenopathy.
3. The secondary treatment includes chemocautarization by 30 to 40 percent trichlor acetic acid to cautarize the opercurculum or operculectomy by electrocautary loop.
4. In case of repeated episodic attack, surgical removal of the offending tooth is a choice of treatment.

Routes of Spread of Orofacial Infection

a. By direct continuity via the tissue.
b. Via the lymphatics into the regional lymph nodes and subsequently into the blood stream.
c. Via the blood stream very rare example local thrombothlebitis may propagate along the veins, entering the cranial cavity via emissary veins to produce cavournous thrombothlebitis.

The Factors Influencing Spread

The general factors includes:
a. Host resistance.
b. Virulence activity of microbes.
c. Compromise proposed defenses.
d. Combination of both.

Local Factors

a. Via alveolar bone.
b. Via periosteum.
c. Adjacent fascia and muscles.

Spread of Infection

The majority of infection remains localized and infection may spread in the form of pus from an infected tooth with spread along the path of least resistance. This may produce an extra-oral and intra-oral discharging sinus. This may spread along the tissues and fascial planes to produce severe life threatening systemic infection. The pattern of spread associated with specific teeth having a distinct correlation can be shown as in Table 18.2.

Fascial Spaces

The fascial spaces are potential areas between layers of fascia. These areas are normally filled with loose connective tissue, which readily breaks down when invaded by infection, as per Shapiro.

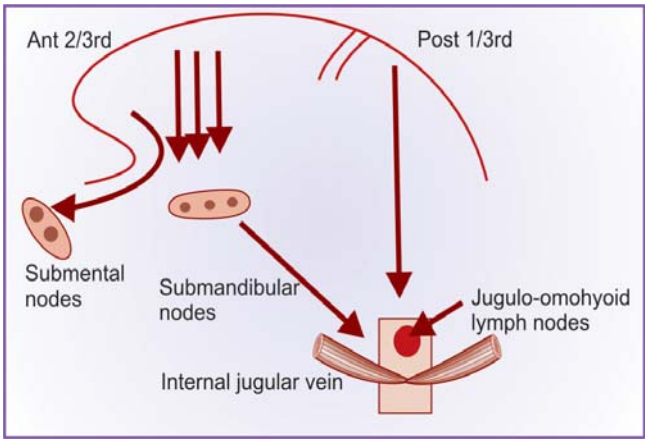


Fig. 18.1: Lymphatic drainage of tongue

Table 18.2: Pattern of spread of odontogenic abscesses according to position of the tooth and the potential path of spread

Tooth	*Potential path of spread*
Maxillary teeth	
Molars and premolars	Swelling or sinus in buccal sulcus may spread to buccal space (lateral to buccinator)
Canine	Canine fossa - facial nasolabial fold area
Lateral incisor	May track to palate due to distal inclination of root, - but usually labial
Cental incisor	Labially - can give a swollen lip
Mandibulor teeth	
Pericoronitis may tack buccally along the inner aspect of buccinator to present in second pre-molar and first molar region. Migratory abscess of buccal sulcus	Both have the potential to spread in various direction, submandibular space via lingual plate, pterygo mandibnular space, lateral pharyngeal space and on down the neck
Second molar	Spread laterally infection from the third molar may gives severe trismus with an extension into the submasseteric space
First molar	Buccally, if lingual may be submental or submandibular depending on level of drainage and mylohyoid attachment
Premolar and canine	Buccally
Incisors	Labially

The location of the lymphatic nodes and the lymphatic drainage areas of the face and neck:

Lymphatic nodes	*The areas of drainage*
Submental	The tip of tongue, part of the floor of the mouth in the midline, mandibular incisors, related gingiva, middle alveolar process and basal bone of the mandible, midportion of lower lip and chin
Submandibular	All maxillary teeth, mandibular teeth except incisors, inferior nasal cavity, palate, body of tongue, upper lip, lateral portion of lower lip, angle of mouth, medial angle of eye, and submittal lymph nodes
Accessory facial infraorbital	Skin of the medial angle of eye, skin of anterior face, superficial part of nose
Buccal	Skin of anterior face, mucous membrane of lips and cheeks
Mandibular	Skin over mandible, mucous membrane of lips and cheeks
Preauricular	Skin inferior to temple, external auditory meatus, lateral part of forehead, lateral part of eyelids, posterior part of cheeks, portion of outer ear, parotid gland
Postauricular	External ear, scalp above and behind the ear
Infra-auricular	Pre and postauricular nodes
Occipital	Scalp posterior to ear, occipital region
Superficial cervical	Pinna and adjoining skin, pre and post auricular nodes
Deep cervical	Submandibular, submental, inferior auricular, tonsillar and tongue nodes.

Facial Cellulites

It is a diffuse inflammation involving subcutaneous and deeper tissues on examination overlying skin is firm without fluctuation. The condition having the rapid onset without any formation of pus.

Treatment

1. Surgical eradication of infected focus.
2. Suitable systemic antibiotics.
3. In case of abscess formation, incision and surgical drainage by Hilton's method is necessary.

Hilton Method

In this technique, a pair of fine sinus forceps are inserted closed into the wound and opened slowly but firmly to separate the soft tissue planes. The forceps are then withdrawn open to avoid damaging nerves or vessels by closing them blind. This procedure is repeated till the abscess is reached and pus discharges. In dental infections, an area of rough cortical bone can be felt on the mandible or maxilla where the periosteum has been raised — cited from Prof JR Moore.

Solnitzky discuss an excellent article describe the relations of **dental infection and facial spaces of the head and neck region**. The most common dental sources of infection are infections of the lower molar teeth. Such infections tend to spread particularly to one of the following compartments or space: the masticator space, the submandibular space, the

sublingual space and temporal space. Infections of the maxillary teeth are less frequent and tend to spread to the pterygopaltine and infratemporal fossae. In either case, the spreading suppurative process may involve secondarily the parotid space the lateral pharyngeal space. In fulminating cases, the infection may spread through the visceral space into the mediastinum.

Submasseteric space infection is characterized by mandibular sub periosteal abscess cellulites of the mandibular area involving medial pterygoid and obviously masseter. Clinically, the feature of trismus, pain and swelling.

Submandibular and sublingual space infection The most serious infection involving the sublingual and submandibular space is Ludwig's angina. This acute overwhelming, generalized condition involving the above spaces. This is a cellulites involving floor of the mouth and quickly extend into the neck. Tongue and floor of the mouth are elevated. As it tracks down to the pharynx, "a hot potato speech" is a very important significance feature. The danger signs are dysphasia and phonation problems includes asphyxia known as edema glottis and need immediate airways establishment by tracheostomy. Recent advancement of antibiotics the cases of Ludwig's angina not commonly seen.

Treatment

1. Reverse 'U' shape incision along the deep part of the chin recommended by Love and Baily for drainage.
2. High doses of suitable systemic antibiotics along with the intravenous or oral fluids and therapeutic oxygen.
3. If necessary tracheostomy for airway establishment.

Necrotizing Fasciitis

This is a rare infection in the head and neck characterized by a rapidly progressive necrosis of fascia and subcutaneous fat, which undermines and eventually causes necrosis of overlying subcutaneous tissue and skin.

Cavernous Sinus Thrombosis

The facial veins do not have any valve. The veins in the facial regions directly communicate with the

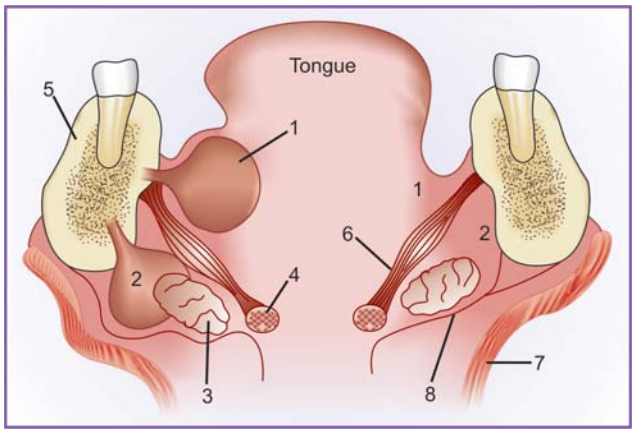


Fig. 18.2: Cross-section of premolar area in mandibular region:
1. Sublingual space
2. Submandibular space
3. Submandibular salivary gland
4. Hyoid bone
5. Mandible
6. Mylohyoid muscle
7. Platysma muscle
8. Deep cervical fascia

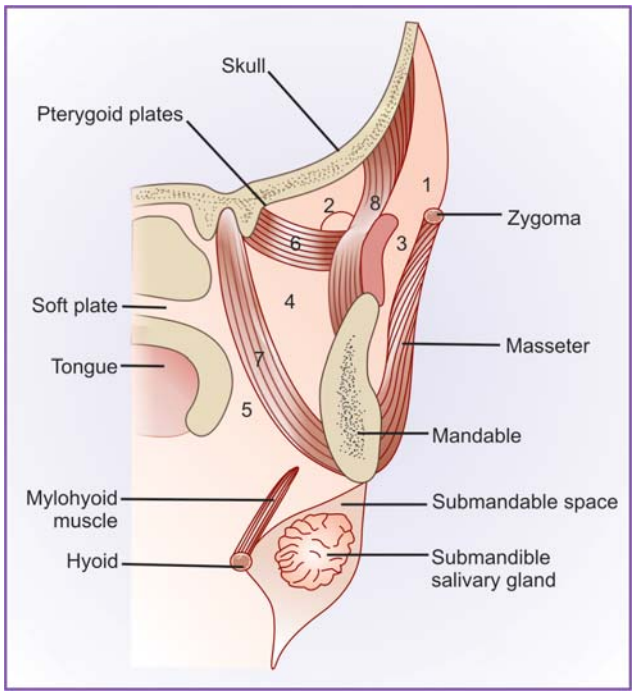


Fig. 18.3: Cross-section of mandibular ramus region:
1. Superficial temporal space
2. Infratemporal space
3. Masseteric space
4. Pterygomandibular space
5. Lateral pharyngeal space
6. Lateral pterygoid muscle
7. Medial pterygoid muscle
8. Temporalis muscle

cranial cavity, and very rarely infection may backtrack from the face up into the skull to the cavernous sinus.

According to Eagleton, the six important features of cavernous sinus thrombosis:

1. A known site of infection.
2. Evidence of blood stream infection (septicemia).
3. Early sign of venous obstruction of the retina, conjunctiva, or eye lid.
4. Paresis of the third, forth and sixth cranial nerves resulting from inflammatory edema.
5. Abscess formation of neighboring soft tissues;
6. Evidence of meningeal irritation.

The condition is very dangerous and fatal to the patient. The recent advancement of antibiotics and the supportive surgical protocol the condition can be controlled before the development of the cavernous sinus thrombosis.

Treatment

1. High doses of selective systemic antibiotics.
2. Fluid transfusion, therapeutic oxygen.
3. Treatment of toxemia.
4. Constant monitor of the patient.
5. In case of edema glottis emergency tracheotomy.

Infection of Nonodontogenic Origin

Any of the spreading infection above may derived from non-odontogenic sources as follows:

1. Salivary Gland: Suppurative parotatis.
2. Skin: Furncle (Suppurative follicutitis), infected sebaceous cyst.
3. Bone: Acute osteomyelitis and chronic osteomyelitis (See the Vol. I).
4. Nasal passages, paranasal sinuses infection (See the Vol. I).

Assessment of Infection

History of the patient includes speed of onset, features of toxemia and difficulty in breathing and swallowing. Medical factors may be due to drugs, diabetes.

Examination includes TPR, heart rate, lymphadenopathy, spread towards floor of the mouth, tongue elevation, neck involvement and special examination of airway and voice. Delineate extend of swallowing as base line. Bacteriological culture includes aspiration of pus and culture. Other test includes radiography, vitality test and urinalysis (routine urine analysis, random blood sugar and PP Blood sugar).

Treatment

1. Removal of infective focus;
2. Incision and drainage by Hilton methods;
3. Suitable appropriate antibiotics, for control of infection;
4. If necessary fluid transfusion;
5. Relief of pain by suitable analgesics.

Some Analytical Observations

1. Submasseteric space infection is more common in Disto Angular impaction as because the insertion of the masserter of the intermediate part is floating or loosely attached below (Bransby and Zachary) Cited from Shafer. The infection and pus may tract the least resistance path under the masseter which is attached to the lateral surface of the ramus of the mandible.
2. Migratory abscess of buccal sulcus is a complication of subacute pericoronitis. Pus may track buccally along inner aspect of the buccinators and discharging extra oral sinus in relation to the first molar and second premolar cited from Howe.
3. Impacted lower third molar have the potential to spread in many directions; some mandibular space via lingual plate, pterygo mandibular space, lateral pharyngeal space and on down the neck. Spreading laterally infection from the third molar may give severe trismus with an extension into the submasseteric space.
4. The choice of antibiotics depends on certain aspects in orofacial infections. The oral surgeon should provide drainage of any collection of pus whether by incision, extirpation of pulp, or extraction. Ideally antibiotics, supplement of drainage, where drainage is possible. But certain clinical features like:
   - Toxemia (↑ temperature and malaise)
   - Associated regional lymphadenitis
   - Trismus
   - Dysphagia
   - Inadequate drainage
   - Supportive medical background
   - Rapid spread towards soft tissue.

Demands Intensive Immediate Antibiotic Therapy

The empirical choice of antibiotics commonly and recent trend of using as follows:

Penicillin derivatives Amoxycillin 500 mg 8 hourly alone and Cloxacillin 500 mg 8 hourly used combine, in case of normal infection.

In case of allergic to penicillin derivatives, Erythromycin 600 mg 6 to 8 hourly may be given. Gentamicin (Genticin actively against some resistance staphylococci and *Seudomonas auriginosa*. 80 mg twice daily by I/M route along with ampicillin 500 mg twice daily by I/M route. Clindamycin a improvised form of Lyncomycin very effective against anaerobic infection and achieve high concentration of bone. It is used in septicemia, severe dental infection and osteomyelitis. The doses are 300 to 600 mg 8 hourly by oral, IM and IV.

Moderate of severe infection author's clinical experience Cefotexime (Omnatax, Taxim) 1 to 2 gm twice daily IM, IV as Ceftrioxone (Monocef 1 to 2 gm IM or IV twice daily is effective.

In addition to that Metronidazole 400 mg 3 times daily in oral route also effective in anaerobic infection in orofacial origin.

Sometimes due to haphazard irregular use of antibiotics surgeon may face difficulty to control infection. In particular case, stoppage of antibiotics for at least 3 days and collection of infected pus or materials for culture and sensitivity may helps proper selection of antibiotics.

Ciprofloxacin 500 mg with Tinidazole 300 mg this combination drugs twice daily commonly routine used in case of average normal orofacial infection for 5 to 7 days.

Typical incision and drainage the various facial spaces recommended by Cunnings et al as A, superficial and deep temporal space, B, submandibular masseteric space and pterygomandibular space, C, submental space, D, lateral pharyngeal and retropharyngeal space.

NINETEEN

Excerpts of Orthognathic Surgery

• Introduction • Role of Orthodontics • Operative Techniques for Correction of Anterior Maxillary Segment • Methods Used to Treat Relative Mandibular Retrognathism and Maxillary Protrusion

INTRODUCTION

To appear attractive to others is a biological instinct of human beings, though, the definition of beauty is only relative to time, place and person. Still facial appearance (symmetry or harmony) has always played the pivotal role in determining the beauty criteria.

Acceptability in society or to be precise, to look normal like others or better than others if not best, face has been considered as a index.

The intense primitive desire to look attractive or at least acceptable particularly for those with congenital malformation, to society, is a driving force from ages in the development of use of beauty aids from the herbs to the present day cosmetics mostly to improve facial appearance. Cosmetic surgery, orthodontics and where orthodontic fails or is not feasible in the treatment of dentofacial disharmony, orthognathic surgery is recommended. The word ortho means straight, nathic means face. The concept of orthognathic surgery actually derived from the fracture mandible and middle-third of the facial skeleton. Thematically the ioatragenic creation of fracture and reduction, and fixation according to the necessity of the correction of jaw deformity. Hence, the orthognathic surgery define as surgery of facial skeleton can radically alter function and appearance; often undertaken in collaboration with specialists in orthodontics, restorative dentistry and prosthodontics.

To initiate the planning of orthognathic surgery certain criteria must be fulfill to achieve the success of the surgery. For our convenience the following nomenclature for terminology which simplify the understanding of various operative procedure.

A. *Alveolar osteotomy:* According to Hinds and Kent alveolar osteotomy is the surgical movement of the teeth and the investing bone with its blood supply maintained in a collateral fashion through the soft tissue. Another definition postulated by Barton and Rayne states that alveolar osteotomy of surgical movement of the teeth together with the alveolar bone.
B. *Alveolar ostectomy:* As per Hinds and Kents's definition alveolar ostectomy is merely an osteotomy with excision of a predetermined segment of alveolar bone. Segmental/alveolar ostectomy is explained by Barton and Rayne as an extension of alveolar ostectomy wherein adjacent segment or segments of bone are excised to reduce horizontal or vertical dimensions. The point of importance in that the vitality of the teeth is maintained, though the innervation of pulp is impaired.
C. *Corticotomy:* On the other hand, is a method of ensuring rapid movements of teeth with their investing bone by utilizing an orthodontic appliance. In corticotomy, complete separation of alveolar processes is not needed. Bonycuts are made in the cortical plate of bone and only the outer cortex is removed. The medullary bone is left undisturbed. Now, it is possible to producing rapid orthodontic movement of the segment.

Role of Orthodontics

Prior to surgery in any case of malocclusion, a complete preliminary study of the case is essential. The various orthodontic diagnostic aids like cephalometry, computerized cephalometry, study of model, soft tissue analysis is necessary for accurate diagnostic and treatment plan.

Harowitz and Hixson defined cephalogram is an oriented roentgenogram, i.e. the position of head and film and the angulation of the central ray are all predetermined and fixed for each and every case.

Though it is only a 'two-dimensional shadow of the three dimensions of the face', its use is invaluable. The various linear and angular measurements of cephalometry help in our study especially to determine :

a. Case analysis and diagnosis,
b. Prognosis during treatment.

Cephalometry was first used by Broadbent of America (1931). His pioneering work was followed by other orthodontists. Brodie Bjork, Downs, Highly, Steiner, Tweed, Ricketts and many others contributed to complete the mosaic of cephalometric diagnosis.

Cephalometric analysis has four Cs namely, (1) To clarify (2) to characterize, (3) to communicate, and (4) to compare (Ricketts 1961).

Though various methods of studying the cephalogram (various analysis) are available, the simplest and most widely used is **Steiner's analysis (1958). Steiner uses the Sella-nasion plane (SN Plane) as the guideline landmark 'A' is the deepest midline point on the premaxilla and 'B' is the corresponding point in mandible.** Angle SNA is the anteroposterior relationship of maxillary basal arch to the anterior cranial base. Angle SNB is the anteroposterior relationship of mandibular basal arch to the anterior cranial base. The difference between angle SNA and angle SNB is angle ANB. Angle SNA is measure of maxillary prognathism angle SNB is thus the relationship of maxillary basal arch to the mandibular basal arch. **In class I arch to the mandibular basal arch. In class I, it is 2° to 4°. In class II malocclusion, it is greater than 4° and in class III malocclusion it is less than 2°.**

Apart from studying the relationship of various hard tissues, soft tissue analysis is also an inseparable part of preliminary investigations. The increased use of maxillary surgical procedure necessitates a judicial assessment of the accompanying soft tissue profile changes. Since the maxillary surgical procedures alter the facial profile, the ability to predict the extent of these changes is essential for treatment planning (Engel et al. 1979).

A number of eminent orthodontists **like Stenier, Ganzalez-Ulloa, Merrifield, Wits and Ricketts** have proposed various techniques for profile measurements. Out of these on indigenous but a very simple method is **that proposed by Ricketts. He describes an E-plane, which is a line tangent to the chin and tip of the nose.** In European races, in adults, the lower lip is located at a distance of 4 mm +/- 3 mm behind the E-plane. The lower lip lies slightly closer to the E-plane than the upper lip. In children, the lower lip lies on the or slightly behind the line because of the delayed development of chin and nose. In Blacks and Chinese adults, the lower lips lines 1 to 3 mm ahead of E-plane and the upper lip is located approximately at the midicine (Fig. 19.1).

A very simple and practical method of determining chin position with facial balance is that advocated by Gonzales-Ulloa. He considers a face beautiful if the chin sis tangent to a vertical line or a ture meridian 0 degrees of the face. One simply draws the Frankfort plane either from the cephalogram or from properly oriented lateral pliotographs, and then places the vertical line perpendicular to the Frankfort plane and through nasion. The normal chin prominence (soft tissue) is tangent or closely aligned to the vertical line. Gonzalez-Ulloa classifies the chin retrusion as first, second, or third degree retraction. This classification is based on increments of millimeters (0 to 10 mm, 10 to 20 mm, greater than 20 mm). Treatment of the chin is based upon this classification (Fig. 19.2).

Mock surgery using a paper cutout should be done preoperatively to determine the postoperative profile, regardless of surgical techniques. The paper cutout may also be helpful in determining the osteotomy plane when utilizing the sliding horizontal osteotomy technique.

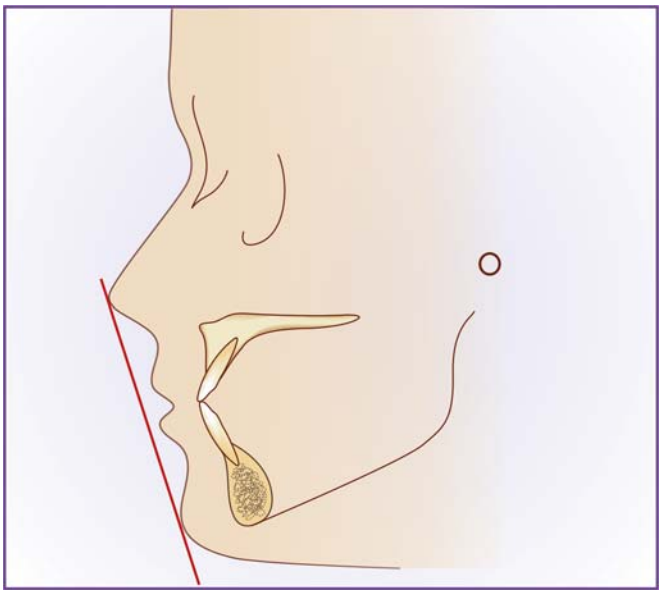


Fig. 19.1: E-plane (esthetic plane) of ricketts

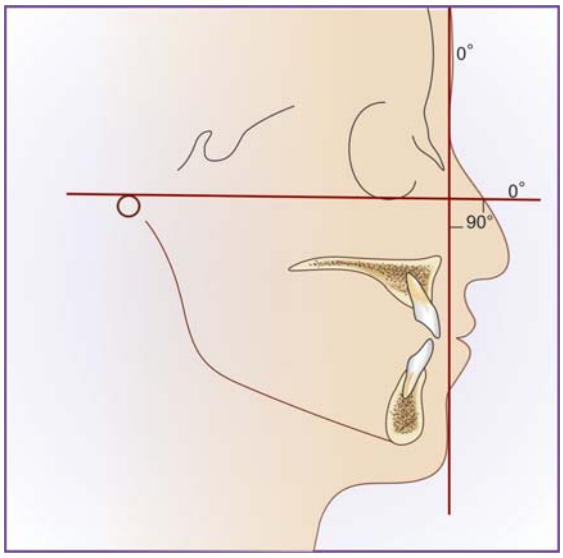


Fig. 19.2: Profile line advocated by Gonzalez–Ulloa is simple and practical

The decision to use a combined surgical orthodontics approach reserved for patients under three categories:

1. Patient having severe dentofacial deformities and orthodontic treatment alone would not produce acceptable esthetics or functional result.
2. Moderate dentofacial deformities for whom to reduce significantly the duration of treatment time (mainly adult patient).
3. Moderate dentofacial deformities and in whom orthodontic treatment alone would adversely affect the facial appearance (mandibular deficiency might be accentuated to the set back maxillary teeth (Stoelinga and Leena).

The choice between orthodontic and surgical treatment is based on the severity of the deformity and the age of the patient. Generally, surgery is preferred when the malformations are very pronounced and when bone growth has ceased. Such operations are justified also when the entire permanent dentition has been completely formed and only partially satisfactory results may be achieved by conservative orthodontic therapy.

The operation to correct maxillary protrution is best performed on patients between the ages of 16-30 years. At this age, it is either too late for orthodontic treatment or a relapse is probate (Kole 1959).

Mohnac in 1966 summarized excellently the indications of anterior maxillary osteotomy as follows:

1. For the correction of open bite when lowering of the anterior portion of the maxilla is indicated for a more normal occlusal relationship and bite closure.
2. For correction of closed bite when the raising the anterior maxillary fragment is indicated.
3. Correction of the under developed maxilla when advancement of a portion of the maxilla or of the entire maxilla is indicated.
4. For correction of protruding maxilla when it is necessary to move the anterior portion of the maxilla posteriorly.
5. In combined procedures in which sectioning of the anterior maxillary segments of bone palatally, superiorly and buccaly to rotate, lower, raise, or set back fragments concurrently with the mandibular correction of class II, class III or open/bite malocclusion.

Surgical treatment of angle class II divisions malocclusion, the advocates of surgical orthodontics point out, reduces the duration of time (Salzman).

Surgical correction of maxillary protrution has been labelled as 'Instant Orthodontia'. Treatment of this malocclusion is sometimes, unpredictable unless concerted efforts of the surgeons and orthodontist are combined (Hinds and Kent 1979).

The surgical principles for correction of maxillary protrusion were established in 1921 in Berlin by Cohnstock. The first attempt was made to retreat the anterior maxilla surgically. A wedge segment of bone was excised from the maxilla through a transverse incision in the palatal mucosa. Because the segment was green stick fractured the maxilla relapsed, to the preoperative position within 4 weeks.

Analysis of Chonstocks initial attempt by Bell's to retroposition the anterior maxilla surgically indicates that he feared the consequences of such procedures and attempted to avoid them by green stick fracturing the anterior maxilla through a transverse palatal incision. The consequent relapse after the fixation appliances were removed is ample testimony to the fact that adequate mobility was not attained by the operation.

In Europe the awakening to the possibilities for surgical correction of facial deformities begun at the then West German maxillofacial clinic in Duesldrof in the year 1927 by Bruhn.

Although maxillary surgery was described in the European Literature over 75 years ago, it was not

performed routinely in the United States until the work of Prof. Heinz Kole of Graz University of Austria was published in the English Literature in 1959. The surgical principle for correction of maxillary protrusion were first made by Wassmund (1935) Spanier (1932), Axhausen (1947), Immenkump (1961) modified and expanded the technique above, who were unaware of the biologic basis of surgically created wound. Fear of loss of blood to the fragment and devitalization of teeth was tempered by development of two stages technique of Schuchardt (1954).

William Bell's micro-angiographic study 1969 to 1973, the original work established the biological basis for surgical treatment following surgical insult to the tissues. Bell original animal study established and explained the theory confirm the long-standing clinical observation, the preservation of a single mucoperiosteal flap is mandatory (Fig. 19.3).

The above study facilitates and confidential support to the operator by William Bell dictums the preservation of single muccoperiostal flap is essential. Operative modalities of anterior maxillary osteotomy of Wassamund subsequently modified by Cuper via labial approach then by Wunderer via palatal approach. Epkar again remodified the Cuper operative technique means via the labial approach the palatal bone cut is made on direct vision.

Though the two basic operative approaches for anterior maxillary osteotomy have been used by most surgeons the Wasmund (1935), and Wunderer (1962), both have been clinically and experimentally tested and found to be sound procedure. Bell (1969), Jensen et al (1976), Sokaloski (1976), Epkar (1977) developed and modified the operative techniques basically recommended by Cuper labial approach (1954) has some techniqual advantages as per author:

1. It is technically simple.
2. Provides direct access to the nasal septal structure and thereby allow one to deal with these structures directly and prevent buckling of the cartilaginous nasal septum.
3. Permits excellent access to the anterior-superior maxilla so that when it is moved superiority it can be readily osteotomized without compromise of the nasal airway.
4. Permits removal of palatal bone under direct visualization.
5. Provides an excellent vascular pedicle.

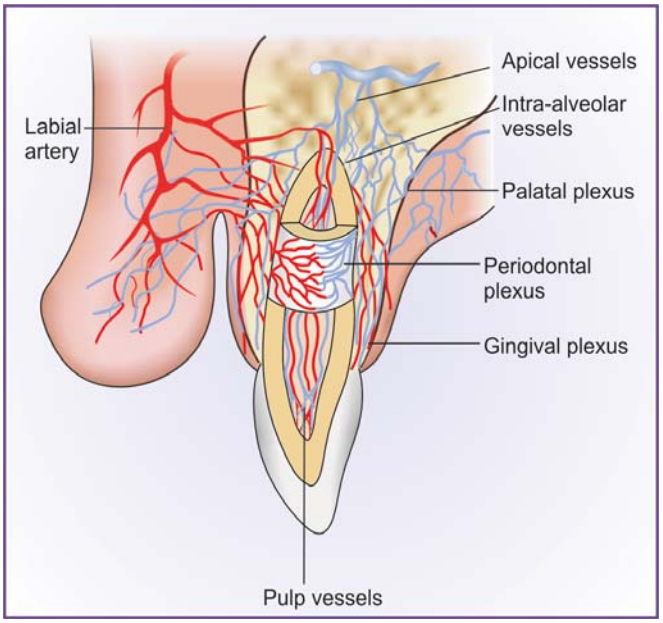


Fig. 19.3: Blood supply to anterior maxillary region showing freely anastomosing gingival plexus, palatal plexus, periodontal plexus, labial artery, intra-alveolar vessels, apical vessels, and pulp vessels. This vascular architecture permits anterior maxillary octotomies to be performed without compromising circulation to the anterior maxillary segment and teeth

Wunderer (1962) developed his procedure to provide palatally oriented approach to the sectioning and repositioning of the anterior maxillary segment. Because the segment is pedicled on the labial periosteum, it is possible to rotate it anteriorly for better visualization of the recipient sites. Hence, the bony trimming takes place under direct vision. A brief outline of above mentioned techniques are summarized.

Outline of Different Operative Techniques for Correction of Anterior Maxillary Segment

See Table 19.1.

Line Diagram of Some Methods used to Treat Relative Mandibular Retrognathism and Maxillary Protrusion

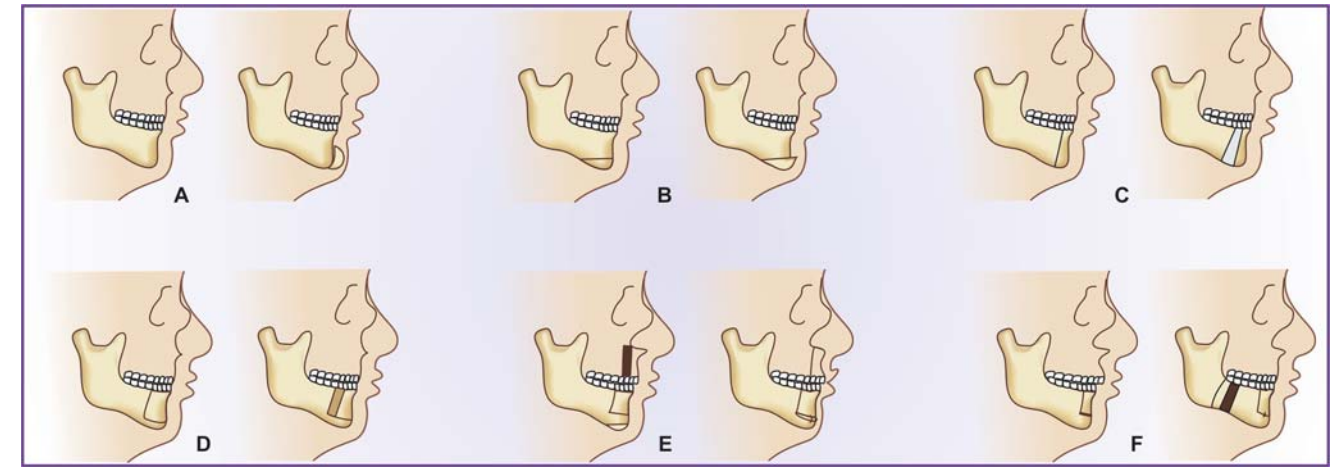
See Figs 19.4 to 19.8.

ANALYTICAL OBSERVATION

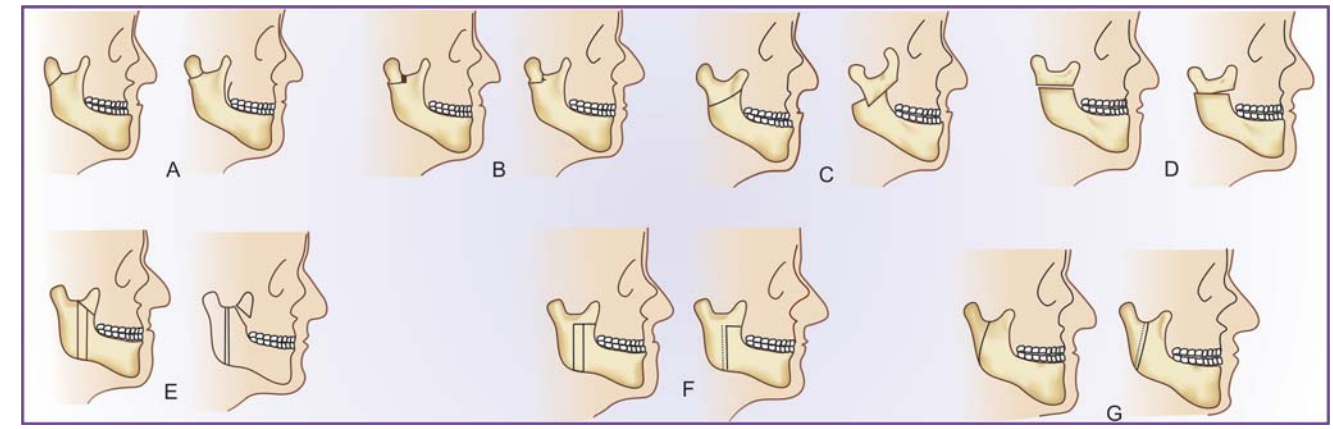
1. Presurgical orthodontic measures and post-surgery orthodontic protocol, causes the less time of total treatment modalities. In addition, the

Table 19.1: Operative techniques for correction of anterior maxillary segment

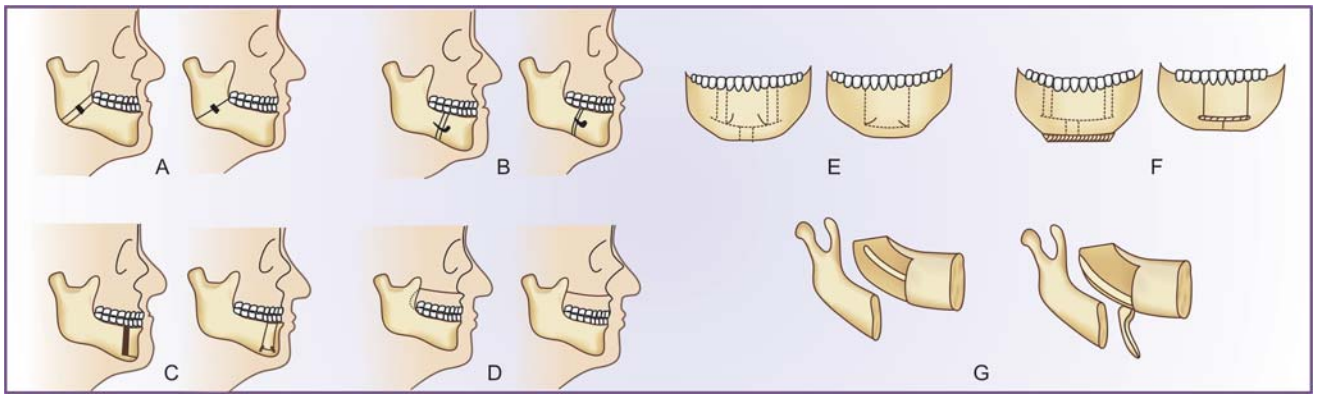
	Surgical approach	*Blood supply*	*Chief indication*	*Advantage*	*Disadvantage*
Cuper method 1954	Via labial incision	From palatal pedicle	Intruding segment	Access to nasal floor	Difficult to retrusion
Wunderer intrusion	Via palatal incision method 1965	From labial	Retruding pedicle	Access to segment	Difficult to palate
Wassmund method 1935	Via tunneling of palatal and labial mucosa	From labial and palatal pedicle	Retruding advancing or lowering segment	Maintenance of blood supply	Limited bony access
Epkar modification 1977	Same as Cuper method approach via nasal floor, palatal bone cut made under direct vision				



Figs 19.4A to G: A. The Chin onlay. B, The sliding genioplasty. C, Body osteotomy and block graft. D, Advancement of the lower incisor segment with the placement of a graft and bridge. E, The Wassmund procedure on the premaxilla combined with the Kole procedure on the mandible. F, Advancement of the mandible using a sagittal spitting procedure combined with lowering of the lower incisor region. G, Seward's modification of the Caldwell procedure whereby a vertical osteotomy is combined with a block graft to advance the mandible



Figs 19.5A to G: Diagram illustrating some ramus procedures used in the treatment of mandibular prognathism. A, Section of the condyle neck. B, Section of the condyle neck with removal of bone from below the sigmoid notch (Smith and Johnson). C, Blind section of the ramus (Kostecka). D, Horizontal ramus section. E, The vertical subsigmoid (Caldwell and Lettermann). F, The inverted L (Trauner). G, Oblique osteotomy (Thoma)



Figs 19.6A to G: Diagram illustrating some angle, body, and maxillary procedures used in the treatment of mandibular prognathism. A, The angle ostectomy. B, The body ostectomy. C, Regression of the lower incisor segments. D, Maxillary osteotomy (Wassmund). E, The Y body ostectomy (Sowray and Haskell). F, The Y body ostectomy combined with the Kole procedure whereby the anterior alveolar segment is raised to close on anterior open bite, the height of the chin is reduced, and the point of the chin raised into the chin pad by wedging the chin fragment into the gap (Obwegeser). G, The Obwegeser-Dal Pont peration (left) and the Dal Pont-Hunsuck variant of the sagittal split (right)

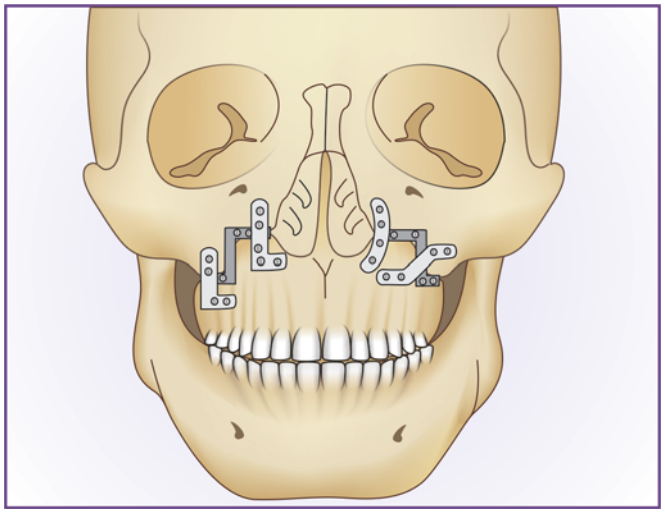


Fig. 19.7: The ideal means of internal fixation is the use of Champy mini plates. These plates are malleable and can be fitted across the posterior and anterior bony buttresses and screwed into plate. An L-shaped plate will avoid the apices of the canine anteriorly, and a horizontal plate across the vertical cut of the posterior step osteotomy to similarly preserve the molar roots

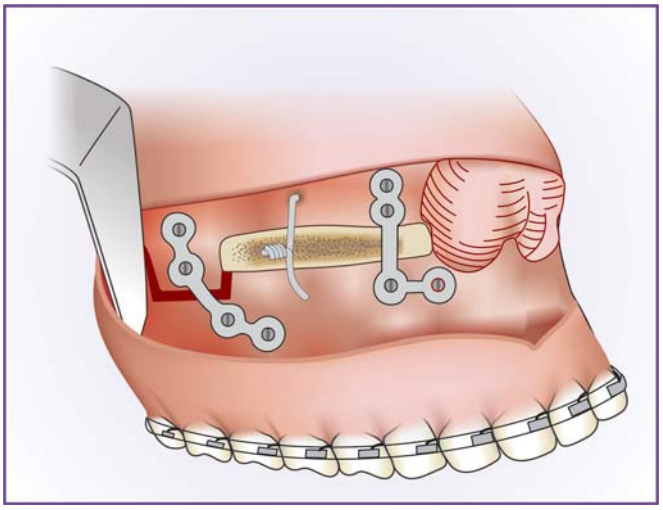


Fig. 19.8: In the above figure, maxilla may be lowered placing blocks of iliac crest cancellous bone or split rib between the cut margins of lateral maxillary wall. Always over-corrected by 25 percent. This procedure will produce a downward and posterior rotation of the mandible. The mini bone plates gives greater stability. Cited from Haris

chances of relapses are minimum. Presurgical arch wires alignment.

2. Model or mock surgery help surgical plan and its require modification.
3. William Bell's microvascular study on rhesus monkeys (1969-75) give support and extra-confidence to the orthognathic surgeons. Prof. Bell's experimentally show the blood supply to the ostotomized segment will maintained adequately, if at least one soft tissue pedicle is preserved intact.
4. Reckett's E-plane (estheticplane) also help for esthetic evaluation.
5. Concept of orthognathic surgery especially maxilla derived from fracture middle third of facial skeleton. Leforte I and II osteotomy.

6. French surgeon Maxim Champy introduced mini plates used for stabilization and fixation of bone after osteotomy.
7. Hind and Kent consider surgical orthodontic as instant orthodontics.
8. Obwegeser and Marentette (1986) concept of three esthetic profile norms is an important reminder to avoid the temptation of fitting all patient into the same mould. The normal patient should be considered to be anterognathic (a) mesognathic (b) retronathic (c) (cited from Harris) (Fig. 19.9).
9. Present author very temptated to quote the Molina F et al. (Plastic Reconstruction Surgery 96: 825-842 in the year 1995) research article in which the author is fare welling to major ostotomies after improvement osteo distraction technique. The comment of Molina is very much questionable and time will establish or reject the above concept.

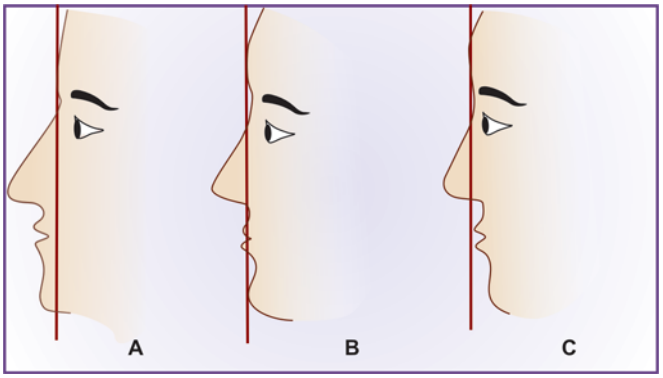


Fig. 19.9

ACKNOWLEDGMENTS

1. Author is personally indebted a lot in early 1980s to Prof. Heinz Kole of Graz University, Austria.
2. Author is personally indebted a lot in early 1980s to Bruce N Epker of United States.

FURTHER READING

1. Derreck Anderson. Orthognatic Surgery.
2. Hind, Kent. Text book of Surgical Orthodontics.
3. Malcom Haris, et al. Fundamental of Orthognathic Surgery.
4. Obwegeser, et al. Profile planning based on alternation in the position of the bases of the facial thirds. JOMFS 1986;44: 302-11.
5. William Bell, Profit. Surgical Orthodontics.

TWENTY

Tidbits of Cryo and Laser Surgery Used in Oral Maxillofacial Surgery

• Cryosurgery • Mechanism of Tissue Destruction • Indications and Contra-indications of Cryosurgery • Analytical Observations • Laser Surgery • Development of Laser Technology • Laser Types • Analytical Observations

CRYOSURGERY

Intense cold kills living tissue. Cryosurgery involves controlled destruction of tissue by freezing. Liquid nitrogen, Nitrous oxide and carbon dioxide taking energy from their surroundings when they vaporize or expand. The clinical application of a freezing probe to living tissues is termed Cryosurgery by Poswillo.

Mechanism of Tissue Destruction Explained by Prof Poswillo

The mode of cell death following cryosurgery is complex. Freezing induces ice crystal formation within cells and extracellular spaces. The intracellular ice crystal may rupture cell membranes where cooling rates are rapid. Slower cooling produces large ice crystal in the space between cells. As the crystal grow, water is removed from neighboring cells leading to an increase in the concentration of electrolytes. These soon reach toxic level, initiating cell death by **osmotic shock** when thawing commences and water returned to the cells.

This can be summarized as:

1. Ice crystal formation extracellular and within the cells;
2. The changes is the osmolarity;
3. Changes in the vascular bed, leads to ischemic necrosis and resulting microthrombi formation within the capillary and arterioles due to vascular stasis;
4. Changes in cellular metabolism, which causes inhibition of enzymes and denaturation of lipoprotein complexes.

Effects of cryosurgery on the tissues is discussed in detail by Prof. Poswillo on general principle of cryosurgery: When the freezing process stops and tissues are allowed to rewarm (Thawing). Soon after thawing, the affected tissues swell and exhibit hyperemia. There may be some postoperative pain at this time but this is readily controlled by mild analgesics. Pain, bleeding and infection are exceedingly rare sequelae of cryosurgery. In skin and mucous membranes, vesicles may form some hours after cryosurgery by the accumulation of extracellular fluid. Occasionally, large superficial blebs may form. Unless evacuated they coagulate and remain on the lesion for several days. More commonly, a slough or eschar forms on the surface of the lesion within 48 hours. There are few, if any, signs of an inflammatory response around the cryolesion and healing occurs by secondary intention. Within 7 days, re-epithelization takes place from the wound margins and healing is usually completed within 2 to 3 weeks. Scarring is noticeably reduced following repair in cryosurgical wounds, particularly in mucous membranes. On the skin, the epithelial cover may remain thin and depigmented for a considerable period after healing.

When bone and cartilage are frozen, they retain their structural integrity, although devitalized, and continue to provide mechanical support for the adjacent soft tissues until repopulated by vital cells. The walls of arteries and the sheaths of nerves are not disrupted by cryosurgery, but retain their morphological features, thus provide facilitating the restoration of function in these structures. Because of these unique biological responses, the over-extension of a cryolesion into adjacent normal structures is often of less concern than would be a similar incident with the diathermy or scalpel.

According to Poswillo, the nitrous oxide system achieves a pro-tissue temperature of around minus

70° centigrade. It uses Joule–Thomson Principle of rapid expansion of a gas-producing freezing. The equipments is simple to use and more suitable for smaller or more superficial lesion. The cryo pro produces the lowest temperature at the tissue probe interface, about –190° centigrade, its use is essential when large or vascular lesions are to be frozen. Liquid nitrogen is a powerful refrigerant and great care must be excised when charging and handling the apparatus. This form of equipments is for the experienced operator. There are various procedures in case of cryosurgical method, dipstick method and spray method.

Dipstick Method

The lesion about 0.5 to 1 centimeter, dipstick method is suitable. Topical anaesthetic may apply to minimize discomfort. The technique consist of dipping a cotton swab into the liquid nitrogen for 1 to 2 second and applying it on the lesion with pressure till the formation of ice crystals that is within 30 to 60 seconds. Following thawing procedure for 60 to 120 seconds. Two consecutive freeze and thaw cycles were used. In this method temperature may be –20ºC and depth upto 2 to 3 mm may be needed. This technique is limited for superficial lesions.

Spray Technique (Fig. 20.1)

Based on the shape and size of the lesions: There are various spray technique:

a. Spot spray free technique for small round lesion < 2 cm in diameter.
b. Overlapping technique for lesion > 2 cm diameter and the field is divided into over lapping circles of 2 cm diameter.
c. Paint brush technique for larger lesions, much longer time is needed for concrete spray. This technique is employed for adequate freezing for irregularly shaped lesions.
d. Spiral spray technique. The spray started in the centre of the lesions and carried in an ever-widening spiral. This is also useful for treating larger lesions.

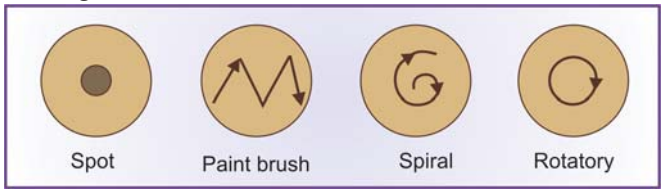


Fig. 20.1: Spray technique

e. Rotatory spray technique. This spray is directed in multiple, concentric circles of increasing diameter, till the whole lesion is frozen.

Prof Paul F Bradly described a variety of methods of freezing bone in the maxillofacial region with object of eradicating neoplastic or other abnormal cellular elements, without the need for radical excision. This was the experimental work by Gag and his team freezing segments bone in dog.

Tissue Response (Fig. 20.2)

The initial necrotic phase lasting several days with a provisional osteogenic phase for some weeks in which new subperiosteal woven bone is laid down over the necrotic bone. Marrow spaces repopulated with fibrous tissue and there is a leaser deposition of endosteal bone. The data in the experimental work is not significant.

The various methods of freezing bone described by various authors:

a. Probe alone shows freezing a mucosal lesion extending into the bone.
b. Pro plus water soluble K Y Jelly freezing a bone cavity after curettage of an intra-bony lesion;
c. Liquid nitrogen spray shows use in a large bone cavity;
d. Liquid nitrogen coil. Liquid nitrogen circulates through a coil around the bone;
e. Explant technique: the segment of bone is removed, frozen in a bathe of liquid nitrogen and then return. Note the central thermocouple (ºC) and holes drilled in cortex (needs further time tested outcome).

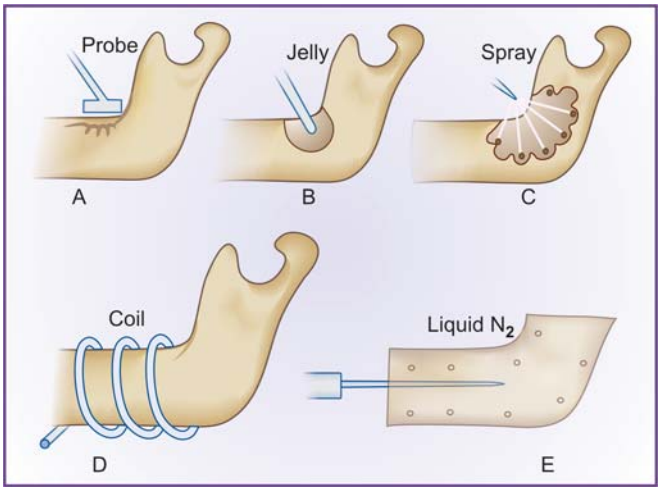


Fig. 20.2: Methods of freezing bone

Indications and Contraindications of Cryosurgery

Prof Setrag A. Zacarian summarized the indications of cryosurgery as follows:

I. *Tumors with definable margins:*
   a. Nodular or ulcerated lesions.
   b. Instrument delineation by means of a curette;
   c. Chemical delineation by means of 5-fluorouracil.
   d. Tumors overlying cartilage and bone.
   e. Lentigo maligna (State I level of invasion).

II. *Nature of the neoplasms:*
   a. Infected tumors.
   b. Recurrent tumors from previous radiotherapy.

III. *Patient with idiosoimcrasies:*
   a. Patient with pacemakers (electro cautery in contraindicated).
   b. Patient old enough to be poor surgical risk.
   c. Patient with anaesthesia idiosymcrasies.

IV. *Inoperable patient:*
   a. Palliation.
   b. Removal of bulk vegetative lesions.

Contraindications

The absolute contraindication of cryosurgery are clear cut and definitive:

1. Intolerance to cold.
2. Cryoglobulinemia.
3. Raynaud's disease.
4. Cold urticaria.
5. Collagen and autoimmune disease.
6. Concurrent treatment with rental dialysis.
7. Concurrent treatment with immunosuppressive drugs.
8. Platelet deficiency disease.
9. Blood dyscrasias disease.
10. Blood dyscrasias of unknown origin.
11. Multiple myelomas.
12. Agammaglobulinemia.

Complications maybe:

I. *Immediate:*
   a. Pain during the freezing and thawing period.
   b. Headache affecting forehead, temples, and scalp.
   c. Insufflations of subcutaneous tissue.
   d. Intradermal hemorrhage.
   e. Edema.
   f. Syncope.
   g. Vesicular-bullous formation.

II. *Delayed:*
   a. Postoperative infection.
   b. Febrile systemic reaction.
   c. Hemorrhage from the wound site.
   d. Pyogenic granuloma.
   e. Pseudoepitheliomatous hyperplasia.

III. *Prolonged:*
   a. Hyperpigmentation.
   b. Development of milia.
   c. Hypertrophic scars.
   d. Neuropathy.

IV. *Permanent:*
   a. Hypopigmentation.
   b. Ectropion and notching of eyelids.
   c. Notching and atrophy of tumors overlying cartilage.
   d. Tenting or notching of the vermilion border of the upper lip.
   e. Atrophy.
   f. Alopecia of hair-bearing sites.

ANALYTICAL OBSERVATIONS

1. Oral white lesions* treated with cryotherapy by Marvin E. Chapin et al. 1973 showed decreased pain bleeding, minimum scar formation. When bone was frozen, there was no formation of sequestrum (*see the photograph in Vol. I)
2. Prof D Proswillo et al. in 1974 stressed on the importance of cryosurgery in the management of premalignant oral lesions and suggested the cryotherapy as a palliative mode in the primary treatment of malignancies.
3. Radden BG et al. observed that oral lesions treated with cryotherapy were followed by formation of extensive granulation tissue with subsequent repair without scar tissues.
4. Prof Paul F Bradly et al. 1975 an experimental and clinical study shows the affects of liquid nitrogen cryosurgery on bone histologically showed three overlapping phases of necrosis, osteogenesis and remodeling.
5. Joanna M Zaakrzewska et al 1988. Eastman Hospital, London showing their six years studies for the management of trigeminal neuralgia with cryotherapy revealed and average period of pain relief 16 to 17 months.

6. Pro Raghabendra Pradhan et al in 1992 an excellent comparative study between scalpel surgery, cryosurgery using nitrated oxide and electro surgery in the treatment of pre-malignant oral lesions. They concluded electro surgery; excision and closer best followed that cryosurgery.
7. Yeh CJ 1965 explained a phenomenon as follows: The tissue mostly freezes at –2.2°C and cell death occurs at a temperature of –20°C after the biochemical changes takes place within the cell least to destruction and sloughing.

It is convenient to the patient especially older and the children. Minimal complication rate with this technique and therefore suitable extensive superficial lesions it can be repeated any number of times. It may be used as an adjunct to surgery and for palliative measures only the postoperative swelling was much more in this technique.

LASER SURGERY (Figs 20.3 to 20.5)

Laser the word L for (Light), A for (Amplification by), S for (Stimulated), E for (Emission of) R for (Radiation). A device that emits and intense coherent directional beam of radiant energy by stimulated electronic for molecular transitions to a lower energy level.

Development of Laser Technology

During early 20th century Neilsbohr of Germany in 1913 and Albert Einstein in 1917 a quantum theory and theory of stimulated emission are initial concept of carbon dioxide. Shafir in 1977 was first documented case in the field of oral and maxillofacial surgery.

Laser types include

- Carbon dioxide.
- Neodymium YAG (yttrium aluminium garnet).
- Argon laser.
- Tunable dye laser.

Carbon dioxide laser offers several advantages over the blade surgical procedure and over chemical in skin rejuvenation. Ablation gross removal of tissue as in tumor removal, debulcking, or vaporization is perform without char and bleeding, operating is minimized and the laser seals blood vessels during surgery with minimal thermal damage to the surrounding tissue. The major intra oral application is an excision of pre-malignant lesions. Excision of soft tissue neoplasms is also possible with models that are more powerful. The depth of destruction can be controlled precisely, and small blood lymphatic vessels are sealed (with possible prevention of tumor spread). Wound produced by a carbon dioxide laser is said to heal with less scarring than other wounds. Fewer myofibrils are generated in healing. This, together with retention of connective tissue skeleton, reduces scar contraction. Carbon dioxide laser surgery may also be associated with less postoperative pain.

The commonly known the advantages and the disadvantages of carbon dioxide laser chronologically arranged by Timothy J. Atkinson as follows:

Advantages

a. Production of a sterile surgical field, bactericidal, vircidal.
b. Minimal cicatrix formation/wound contraction.
c. Access to difficult to reach anatomic sites by reflection or through waveguides.
d. Ability to coagulate, vaporize, or incise tissue.
e. Good hemostasis.
f. Reduced local tissue trauma and edema.
g. Precise delivery of energy to diseased tissue via microscopes for reduced damage to surrounding structure.
h. Reduced pain by induced neural anaesthesia as a function of neuron sealing and decreased pain mediator release.
i. Minimized tumor cell dispersion by lymphatic sealing.

Disadvantages

a. Specialized didactic and clinically oriented instruction required for laser use by the surgeon and ancillary assistants.
b. Hazards to patient, operating and assistant team, and anesthesia personnel from misdirected and inadvertent laser radiation.
c. Expense of laser equipment.
d. Specialized wiring and plumbing connection.
e. Maintenance requirements.
f. Fire hazard as related to anaesthesia risk.
g. Electrical hazards of laser equipment.

Neodymium YAG (yttrium aluminium garnet) laser: The laser is composed of a medium consisting of a YAG crystal "doped" with a rare earth element, neodymium. This laser is capable of stimulated emission when excited by external energy (e.g., xenon

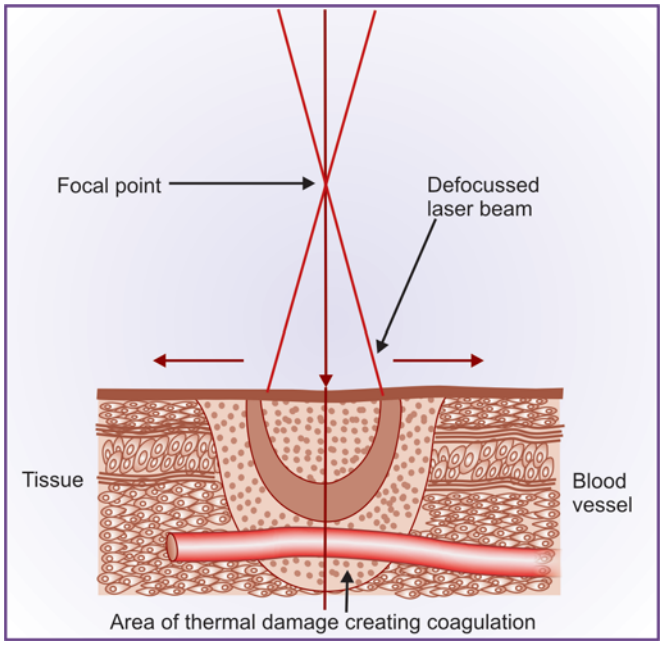


Fig. 20.3: Defocusing the laser beam decreases the power density and increases thermal conduction and coagulation capability

flash lamp) and can emit radiant energy at 1.06 microns, which is absorbed within 30 mm of tissue with moderate lateral scattering. Nd: YAG is known as a dopedinsulator laser, the YAG acting as the insulator and the Nd as the dope.

Argon laser: A visible light laser producing radiant energy of a 488- or 514 nm wavelength in which argon gas is the active medium after ionization either by an electric charge (electron beam) or by energy from a diode laser.

Tunable dye laser: A laser in which an organic dye is dissolved in a solvent and is the active medium. These lasers are tunable by adjusting the dye medium and the excitation radiation.

Photocoagulation: During the laser surgery it is observed irreversible, denaturation of tissue proteins heated between 50 to 200ºC the zone of coagulation necrosis is produced. During the incision of tissue the carbon dioxide laser can concurrently blood vessels upto 0.5 mm diameter. Larger vessels, upto 2 mm diameter requires interruption of the incising process and defocusing of the laser beam to cause coagulation.

Incision: Laser can be used easily to create surgical incisions without tissue contact. This is accomplished

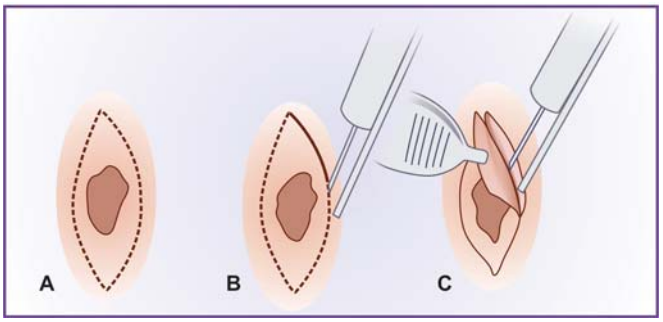


Fig. 20.4: Excisional and incisional biopsies can be promoted. A, First, an outline is made with adequate margins around the altered tissue to be excised, with the laser beam perpendicular to the surface. B, A forceps is used elevate a margin and the specimen is raised ahead of the laser beam thus excising the lesion. Larger vessels (upto 2.0 mm) that continue to hemorrhage can be coagulated by defocusing a continuous-wave laser beam (A laser that emits a continuous laser beam without pulses). C, The resultant wound can be left to granulate secondarily or closed primarily in a routine fashion (Adapted from Pick R, Pecaro)

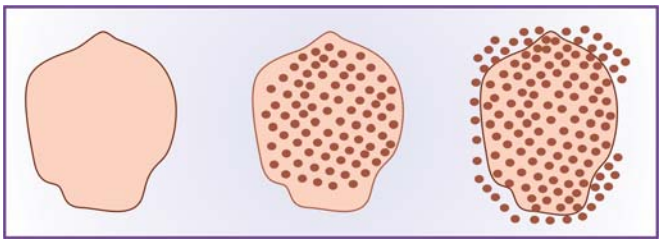


Fig. 20.5: Laser vaporization/ablation is accomplished by first achieving the critical power density, which is 50 watt/cm^2. Using a pulsed mode in a crosshatch pattern, the lesion is removed with minimal thermal damage adjacent tissue

by focusing the laser beam onto the tissue surfaces with a smallest spot size possible, which posses the highest power density.

The Laser Surgical Environment

1. The surgeon should have thorough knowledge in laser tissue reactions.
2. The assistant should be trained and prepared to make any adjustment in the laser's timing or power during the procedure.
3. Care must be given for the comfort of the patient and surgical team, the ease of surgeon access and correct equipment setup. Personal safety precaution must be taken for the patient and all the members of the surgical team.

Argon laser was one of the first lasers to be used in the treatment of vascular lesions.

CW laser or pulsed dye laser has become an excellent modality for the treatment of superficial vascular lesions such as telangiectasias, hemangiomas, port winestaim.

Q-switched Nd

YAG Laser, which produced very high energies. It has found great useful for the treatment of oral pigmented lesions.

Defused intraoral surface lesions includes focal hyperkeratosis, nicotinic stomatitis, erythroplakia, verrucous carcinoma, oral papillomatosis, leukoplakia can be treated by laser surgery according to Catone.

Benign lesions of the tongue amenable to laser treatment include:

- Fibroma
- Papilloma
- Granular cell tumor (granular cell myoblastoma)
- Lingual thyroid nodule
- Hemangioma
- Lymphangioma
- Lingual tonsil
- Pyogenic granuloma
- Lipoma
- Aphthous ulcer.

Some lesions of the lips amenable to laser surgery include:

- Mucocele
- Pyogenic granuloma
- Fibroma
- Actinic cheilitis
- Hemangioma
- Aphthous ulcers.

Lesions of the buccal/cheek mucosal with the laser include:

- Hyperkeratosis/dysplasia
- Fibroma
- Pyogenic granuloma
- Hemangioma/lymphangioma
- Salivary gland tumors
- Hyperplastic tissue, scar tissue
- Lichen planus.

Some lesions involving floor of the mouth may have difficult access, prominent vascularity leading to vision-obstructing bleeding, an extreme tissue distensibility often makes scal surgery of the floor of the mouth a tedious and difficult task. The hemostasis and non-tactile surgical nature of the laser. It is favourable to use in this anatomic region by carbon dioxide laser. The following lesions treatable by lasers:

- "Ranula" (mucous escape phenomenon)
- Salivary gland tumors
- Sialolithiasis
- Hemangioma
- Lymphangioma
- Dysplasia/leukoplakia
- Ankyloglossia

Some Analytical Observations

1. The laser surgery is highly cost oriented surgical modalities.
2. The separate surgical environment is mandatory for this surgery.
3. The special knowledge and training is needed the operative surgeons as well as the assistance.
4. Though the laser surgery is an avascular surgery in spite of that it has limitations for the surgical viewpoint.
5. The surgical removal of growth by laser achieve only in ablative surgery or due to vaporization.
6. Guy A. Catone also reported open laser TMJ. Arthroplasty via preauricular approach or question mark incision of Adil Alkyte and Paul Bramly.
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TWENTY-ONE

Hemorrhage and Shock

• Definition of Hemorrhage, Shock, and Types • Various Coagulation Factors and Hemostasis • Prof. Macferlane Cascade Theory • Detection of Bleeding Disorder, Determine on History, Examination finding and the Screening Laboratory Test • Types of Hemorrhage from Different Vessels and Bone. Treatment Modalities of Hemorrhage • Medicinal Management of Bleeding Disorder • Pathophysiology of Shock • Different Types of Shock and the Clinical Features and Supportive Treatment Measures

HEMORRHAGE

Hemorrhage or bleeding is escape of blood from the vessels due to damage or injury in vasculature. Hemorrhage can be:

a. *Primary:* Hemorrhage during surgery or persisting bleeding from surgical wound.
b. *Intermediate or reactionary*: It is due to within rise of blood pressure following immediate after 24 hours of surgery.
c. *Secondary*: Hemorrhage after 48 to 72 hours due to infection. The digestion of the clot due to liberation of bacterial toxin from infection.

Other hemorrhage includes *petechial hemorrhage* seen in subcutaneous or submucosal area in the form of minutes pinpoint spots. *Ecchymosis*, the large area of bluish or purple coloration of the skin or mucous membrane due to extravasations of the blood into the subcutaneous tissues.

Hematoma

Collection of blood in the facial planes due to injury or surgical trauma.

Other types of hemorrhage includes:

a. Arterial.
b. Venous.
c. Capillary.
d. Bony.

Arterial bleeding characterized by bright red in color with pulsating flow.

Venous bleeding is characterized by non-pulsating dark red colour of the blood with a steady flow.

Capillary bleeding oozing bright red blood from the capillary bed.

Bony bleeding from the nutrient vessels of the bone. This short of bleeding mostly found during removal of lower third molar from the bony bed.

The hemostasis meaning the control or arrest of the bleeding. There are four important steps of hemostasis.

1. The injured blood vessels attempt to reduce blood flow undergoes constriction due to curling of the intima causes spasm in the vessel wall.

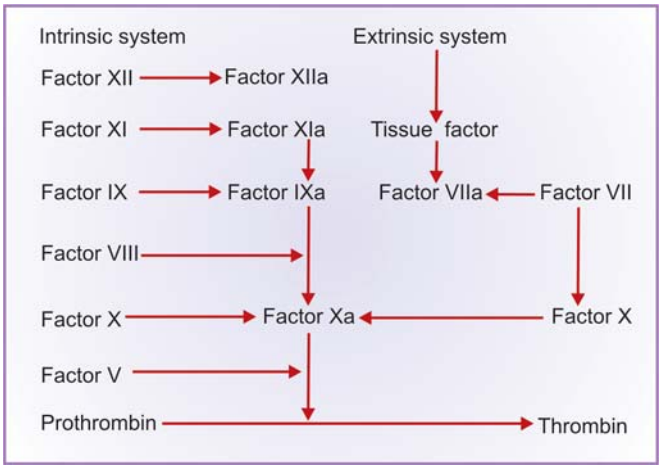

Fig. 21.1: Cited from D. M. Harmening-Clinical Hematology and Fundamental of Hemostasis, 1992

Table 21.1: Classification of various coagulation factors (Fig. 21.1)

1. Substrates	
Factor I	Fibrinogen
2. Cofactors – accelerate enzymatic reactions	
Factor III	Tissue factor (thromboplastin)
Factor V	Labile factor
Factor VIII	Antihemophilic factor
Fitzgerald factor	High-molecullar-weight kininogen (HMWK)
3. Enzymes	
a. Serine proteases	
Factor II	Prothrombin
Factor VII	Proconvertin
Factor IX	Plasma thromboplastin component
Factor X	Stuart –Prower factor
Factor XI	Plasma thromboplastin antecedent
Factor XII	Hageman factor
b. Transamidase	
Factor XIII	Fibrin-stabilization factor
4. Contact proteins	
Factor XI	Plasma thromboplastin antecedent
Factor XII	Hageman factor
Fletcher factor	Prekallikrein
Fitzgerald factor	HMWK
5. Prothrombin proteins (vitamin K-dependent factors II, VII, IX, X	
6. Fibrinogen group (high-molecular-weight) factors I, V, VIII, XIII	

2. Activation of platelets and formation of platelet plug.
3. Coagulation: Activation of clotting mechanism and formation of clot leads to secondary hemostasis (by physiological process). Coagulation is an auto-catalytic reaction a short of chain reaction which ones started end in completion keeping the only one motto, clot formation. There are several theories have been postulated from time to time starting from Morawitz via Howel, end in Prof. Macferlane Cascade Theory.
4. Fibrous organization of the clot or retraction of clot.

Hence, the primary hemostasis is a process of platelet plug formation at the site of injury. Secondary hemostasis is activation of clotting process of plasma resulting the formation fibrin. This can be summarized

a. Platelets + Ca^{++} + Thromboplastin Precursor = Thromboplastin. Which is present in plasma. AHG VIII PTC IX X PTA XI XII + Accessory factor VI VII and AHG
b. Prothrombin (Source from vitamin K + Thrombo-plastin + AF = Thrombin
c. Fibrinogen + Thrombin = Clot + FSF = Fibrin.

Detection of bleeding disorder, determine on history, examination finding and the screening laboratory test:

- No clinical or historical clues to bleeding problem; excessive bleeding occurs after surgery;
- History or clinical findings or both suggest possible bleeding problem but no clues to cause the following:
  - PT
  - apt
  - TT
  - PFA-100 or BT
  - Platelet count.
- Aspirin therapy: PFA-100 or BT
- Coumarin therapy: PT
  Low-molecular weight heparin: apt
- Possible liver disease: Platelet count, PT
- Chronic leukemia: Platelet count;
- Malabsorption syndrome or long-term antibiotic therapy: PT
- Renal dialysis (heparin): apt
- Vascular wall alteration: BT (results often inconsistent);
- Primary fibrinogenolysis (active plasmin in circulation), cancers (lung, prostate): TT.

Screening laboratory test:

- PT—activated by tissue thromboplastin
  a. Tests extrinsic and common pathways;
  b. Control should be run;
  c. Normal (11 to 15 seconds, depending on laboratory);
  d. Control must be in normal range.
- aTT—Initiated by phospholipid platelet substitute and activated by addition of contact activator (kaolin)
  a. Tests intrinsic and common pathway;
  b. Control should be run;
  c. Normal (25 to 35 seconds, depending on laboratory);
  d. Control must be in normal range;
- TT—activated by thrombin;
  a. Tests ability to form initial clot from fibrinogen;
  b. Controls should be run;
  c. Normal (9 to 13 seconds);
- PFA-100*
  a. Tests platelet function;
  b. Normal if adequate number of platelets of good quality present;
  c. Normal (60 to 120 seconds);

- Platelet count
  a. Tests platelet phase for adequate number of platelets;
  b. Normal (140,000 to 400,000/mm^3);
  c. Clinical bleeding problem can occur if less than 50,000/mm^3.

Treatment modalities of hemorrhage or bleeding:

Bleeding (par-operative, reactive and postoperative):

Bleeding → During extraction
Bleeding → Reactive bleeding after 24 hrs
Bleeding → Post-extraction after 48–72 hrs

During extraction or paroperative bleeding:

Careful about tender handling of the soft tissue and alveolar bone. It will definitely help to control par operative extraction bleeding. Undue trauma causes damaging the nutrient vessels of the bone.

The reactive bleeding: It is mostly due to the rise of blood pressure in some patients because of apprehension and fear of post extraction bleeding. The semi supine position preferably sitting *posture* helps to reduce the bleeding and maximum visual and mechanical access can be achieved to control the above problem.

Treatment includes reassurance. Diazepam 5 mg. at bedtime or if necessary antihypertensive treatment with consultation of physician or cardiologist.

Postextraction bleeding after 48 to 72 hours:

The postextraction bleeding is mostly due to infection. The toxin liberated by the local bacteria which digest the clot.

Management of bleeding maybe summarized as:

3P and 3S

3P → Pressure
3P → Pack
3P → Posture

3S → Saline
3S → Styptic
3S → Suture

Treatment modalities maybe a combination of both or according to the case.

Bleeding from the capillary bed presented by oozing of blood.

Controlled method application of local haemostatic (styptic) like adenochorome monosemi carbazone (locally and systematic methods)
E.A.C.A (Epsilon aminocaproic acid) (local and systemic)
Ethampsylate (local and systemic)
Oxidized cellulose, (oxycel, local)
Human thrombin powder (local)

Surgicel: It is glucose polymer-based, sterile knitted fabric by the control oxidation of regenerated cellulose (local hemostatic).

Fibrin Glue (local hemostatic). It is a biological adhesive, composed of thrombin, fibrinogen and factor XIII and aprotinin.

Thrombin converts fibrinogen to unstable fibrin clot, factor XIII stabilize the clot and aprotinin prevents its degradation.

Hemolock (Feracrylum HCl)

Pressure and pack with soaked and dried with white head varnish gauge. Suture if necessary.

Bleeding from the arterial wall and the vein mostly due to trauma or injury. The spurting of blood, frank red in colour in case of injury to the artery. In case of vein non-pulsating, steady flow of blood dark red in colour

Management

Catch hold the artery, vein, and ligate.
Surgical diathermy.
Or
Electrocoagulation/Argon beam coagulator (a superior form of electrocoagulation method using Argon gas)

Bleeding from the bony bed.
Crush the nutrient vessels supply the bone by blunt instruments or artery forceps.
Application of Horsley's bone wax (Bees wax 7 parts, olive oil 2 parts, phenol 1 part).

After control suture with pressure pack.

Post-extraction bleeding usually the disturbances of clot and due to intervention of infection. After obtain L. A. removal of infected clot. Irrigation with normal saline or povidone iodine or hydrogen peroxide. Control of bleeding by pressure pack and sutures.

Then suitable *antibiotics* are the main treatment modalities as because the cause is due to infection.

Analgesics to relieve pain and above selected measures may be used.

The treatment modalities of hemorrhage or bleeding based on three basic perspectives:

1. Sought the cause.
2. Remove the cause.
3. The consequence of hemorrhage, which may lead to hypovolumic shock.

In addition to the above, surgical protocol the following supporting measures is mandatory for management, which includes:

1. Transfusion of fluids;
2. Plasma expander;
3. Transfusion of blood;

Criteria

a. To maintain blood volume on the basis of degree of loss of blood and replace accordingly to prevent shock.
b. To improve oxygen carrying capacity.

4. Cryoprecipitate AHG;
   a. To promote or maintain coagulation;
5. Platelet transfusion.

The above measures according to case and need base. The management of different bleeding disorder summarized as follows:

In case of surgical protocol requires certain need base essential amenities and the preparation prior to operative session:

1. Selection of anaesthesia;
   a. Malamed intraligamentary local anesthesia is preferable.
   b. Above anesthetic procedure under deep sedation (injection diazepam fortwin I/V).
   c. Short-acting enfluren or halothane usually not used now a days may be used as inhalation anesthesia.
2. Preparation of pre-formed hemorrhagic splint made of stent compound or clear acrylic.
3. White head varnish pack or zinc oxide euginol pack is necessary prior to surgical procedure.

Table 21.2: Medical treatment of bleeding disorders

Condition	*Defect*	*Medical Treatment*
Hemophilia B Primary thrombocytopenia (idiopathic thrombocytopenia)	Deficiency or defect in F-IX Platelets destroyed by autoimmune process	F-IX Prednisone IV gamma globulin Platelet transfusion
Hemophilia A	Deficiency or defect in F-VIII Some patients develop antibodies (inhibitors) to F-VIII	Porcine F-VIII, PCC, APCC, F-VIIa, and/or steroids for patients with inhibitors
von Willebrand's disease	Deficiency or defect in vWF causing poor platelet adhesion and in some cases deficiency of F-VIII	DDAVP EACA F-VIII replacement that retains Vwf DDAVP
Secondary thrombocytopenia	Deficiency of platelet because of accelerated destruction or consumption, deficient production, or abnormal pooling	Platelet transfusion
Bernard-Soulier disease	Genetic defect in platelet membrane, absence of glycoprotein Ib causes disorder in platelet adhesion	Platelet transfusion
Liver disease	Multiple coagulation factor defects Patients with portal hypertension may be thrombocytopenic	Vitamin K Replacement therapy only for serious bleeding or before surgical procedures. DDAVP provides some benefit.
DIC	Multiple coagulation factor defects due to triggered consumption. Formation of fibrin and fibrinogen degradation products due to fibrinolysis. Thrombocytopenia	Treatment of primary disorder. Heparin Cryoprecipitate for replacement of fibrinogen. Platelet transfusion. Other blood product replacement leads to mixed results.

4. Surgery must be done carefully atraumatically and tissue should be handle with tender care. In addition to that, the medicinal management mentioned below:

Shock

Shock is defined as inadequate blood flow to vital organs or failure of the cells of vital organs to utilize oxygen (MacLean). MacLean recommended eight measures for monitoring all types of shock.

1. Arterial blood pressure (normal range of adult, 120/80 mm of Hg plus/minus 10 mm);
2. Pulse rate (80/min);
3. Central venous pressure (5 cm H_2O);
4. Urine flow (50 ml per hour);
5. Cardiac index (3.2 L/min/m^2)
6. Arterial blood – PO_2 (100 mm Hg); pCO_2 (40 mm Hg) and pH (7.4);
7. Arterial blood lactate (12 mg/100 ml);
8. Hematocrit (35 to 45%).

Shock can be classified mainly into four types on the perspective of patho physiology and rapid haemodynamic changes.

As per classification, they are follows:

1. Hypovolemic shock.
2. Cardiogenic shock.
3. Septic shock.
4. Neurogenic shock.

Hypovolemic Shock

In oral maxillofacial surgery the hypovolaemic shock as result of maxillofacial trauma or injury leads profuse bleeding or due to surgical problems. The hemorrhage causes decrease venous return → decrease cardiac output decrease blood volume →decrease tissue perfusion → leads to tissue hypoxia → hypotension → shock.

Cardiogenic Shock

As a result of inadequate cardiac output → reduce oxygen supply → reduce tissue perfusion which leads to effective contractile function of the myocardium.

Septic Shock

Septic shock is due to severe septicemia and resulting toxemia. Development of sepsis is related to complex interplay between endotoxin, release of pro-anti-inflammatory mediators, like tumor necrosis factor, alpha, interleukins and prostaglandins. The patho-physiology of septic shock is an extremely complex mechanism interaction between tissue hypoxia and the host's immune response and the cause of death sepsis-induced multiorgan failure.

Neurogenic Shock

Neurogenic shock occurs due to sympathetic nervous system blockage, therefore the dilatation of capillaries, veins and arterioles → pulling of blood → leads to hypovolumia → hypotension → shock.

The clinical features of shock:

a. Mild < 20 percent blood loss showing the features of cold calmy mois skin, fall of blood pressure, rapid pulse, collapsed neck veins, concentrated urine;
b. Moderate > 20 to 40 percent blood loss feeling of thirsty, supine hypotension with rapid pulse, oliguria or anuria;
c. Severe > 40 percent blood loss patient is agitated, confused, supine hypotension, rapid and thready pulse, positive findings, rapid respiration.

Management of hypovolaemic shock based on three basic principles:

a. Controlled bleeding that means ensure hemostasis;
b. Maintain homeostasis (maintenance of internal environment) by appropriate fluid therapy;
c. Assure oxygen exchange (Therapeutic oxygen under pressure).

The above-recommended measures are already discussed at the early part of this chapter.

Management of cardiogenic shock includes with the consultation of cardiologist. Dopamine is a vasopressor may be recommended with normal saline or 5 percent dextrose I/V drip given at 5 to 10 microgram kg./minute. Management of septic shock based on:

a. Replacement of the fluid therapy;
b. Therapeutic oxygen;
c. High doses of selective antibiotic therapy;
d. Removal of source of infection;
e. IV use of betamethasone/dexamethasone (betnesol/decadron)

Management of neurogenic shock includes vasovagal syncope activated by sympathetic stimulation → dilatation of vessels of muscles → pulling of blood in the lymps → transient ischemia of brain leads to loss of consciousness (syncope).

The clinical features include:
1. Pail or ashen skin.
2. Sweating with nausea.
3. Rapid pulse.
4. Pallor tongue and lip in early stages.

In late stages:
1. Cold calmy skin.
2. Fall of blood pressure.
3. Pupil dilated.
4. Slow pulse.
5. Dizziness.
6. Visual disturbances, and
7. Loss of consciousness.

Management of Vasovagal Shock

Prevention

a. Reassurance.
b. To achieve confidence of the patient with soft conversation.
c. Anxiolytic medicine prior to surgery. Diazepam (5 mg) day before surgery night and one tablet half an hour before surgery.
d. Patient should not come with empty stomach.

Treatment

1. Change the patient position. Sitting to supine. Head should be lower than feet (15º Trendlenberg position).
2. Flashing the face with cold water.
3. Therapeutic oxygen inhalation.
4. Sp. Ammon Aromaticus (stimulant haustus).
5. Glucose drinks.
6. Injection dexamethasone if necessary.
7. Injection mephetemine sulphate is given in case of fall of B.P.
8. If the pulse is extremely weak, injection atropine sulphate is given slow IV 0.6 mg diluted in 5 ml distilled water till the pulse become palpable.

TWENTY-TWO

Cleft Lip and Palate

• Introduction • Classification • Embryology • Etiology • Anatomy • Clinical Presentation • Management • Neonatal Care • Surgical Timing • Preoperative Preparation • Anesthesia • Surgery • Secondary Surgery • Palatal Revision

Introduction

Cleft lip and palate are the most commonly found facial congenital anomaly, it constitute 80 percent of orofacial cleft. Cleft of the lip and palate may occur in isolation or involve both lip and palate together. The incidence of cleft lip among Caucasians is higher than the Africans, Europeans and Japanese. Incidence among the Asians varies from 1 in 400 to 500 life-births and 1 in 1500 to 2000 among the Americans. However, incidence of isolated cleft palate is similar among the races (0.50 in 1000 life-births). The left-sided cleft lip has higher incidence than the right. But, the etiology is unknown. The cleft lip and palate have a higher incidence among close relatives (Figs 22.1 to 22.11).

Classification

There are different methods of classification of cleft lip and palate. Cleft lip may be complete or incomplete and may be associated with cleft of the alveolus and palate (figure). The cleft of the lip anterior to incisive foramen is called the cleft of the primary palate. This primary cleft palate may be unilateral or bilateral and may be complete or incomplete (figure). The cleft passes entirely between the lateral incisor and canine teeth and passes in a V-shaped manner. Midline cleft lip is a rare occurrence. The cleft of the palate posterior to incisive foramen is called secondary palate. The cleft of the secondary palate may involve both hard and soft palate. However, classification based on Kernahan and Stark is simple and generally acceptable.

Kernahan and Stark's Classification

1. *Cleft of Primary Palate*
   Unilateral—Complete
   —Incomplete
   Bilateral—Complete
   —Incomplete
   Midline—Complete
   —Incomplete
2. *Cleft of Secondary Palate*
   —Complete
   —Incomplete
   —Submucus
3. *Cleft of both Primary and Secondary Palate*
   Unilateral—Complete
   —Incomplete
   Bilateral—Complete
   —Incomplete
   Midline—Complete
   —Incomplete

Embryology of Cleft Lip and Palate

The face is developed from five processes as a result of migration and proliferation of neural crest mescenchyme. The frontonasal process, a pair of maxillary process and a pair of mandibular arches coalesce together around the stomodeum near the fifth week of embryo to form the face. The formation of olfactory pits divides the frontonasal process into median nasal process and lateral nasal process. The lateral nasal process forms the alae of the nose. Median nasal process extends caudally and forms bilateral elevations called globular process. The fusion of globular process and maxillary process gives rise to the formation of upper lip. The globular process fuse in the midline to form philtrum. The triangular shaped area in front of incisive foramen and between the four incisor teeth constitute the premaxilla (primary palate). The failure of fusion of the globular process with the maxillary process or mesenchymal dehiscence gives rise to different types of cleft lip.

This chapter written by Prof D Basak, MS and Mch.

Fig. 22.1: Incomplete cleft lip (unilateral)

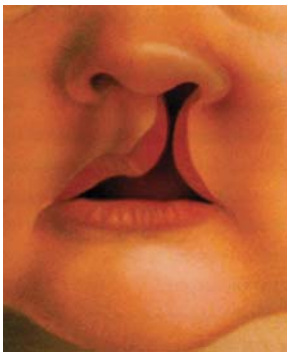

Fig. 22.2: Complete cleft lip (unilateral)

Fig. 22.3: Bilateral cleft lip and alveolus

Fig. 22.4: Incomplete cleft palate

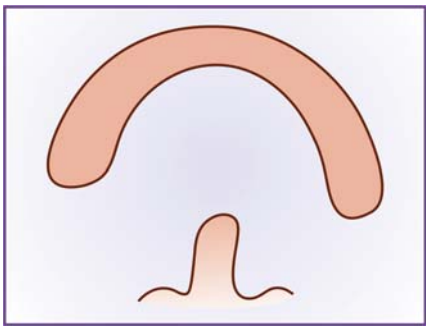

Fig. 22.5: Incomplete cleft palate

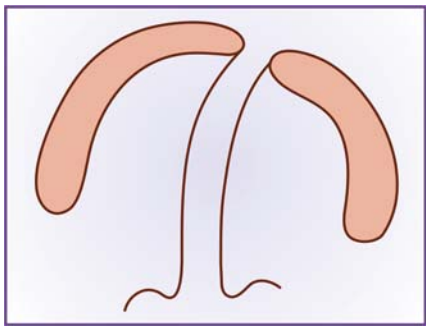

Fig. 22.6: Complete cleft palate and alveolus

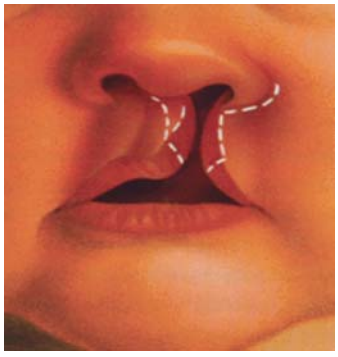

Fig. 22.7: Complete cleft palate

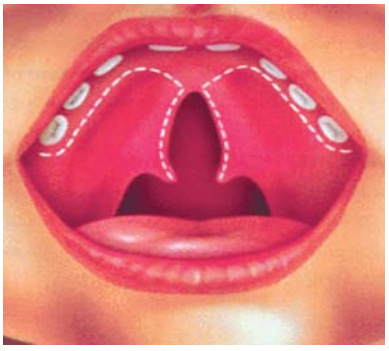

Fig. 22.8: Bilateral complete cleft palate with premaxilla and nasal septum

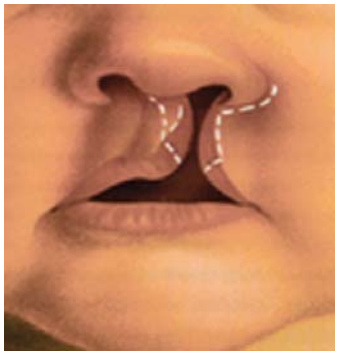

Fig. 22.9A: Millard repair of cleft lip showing the incision line

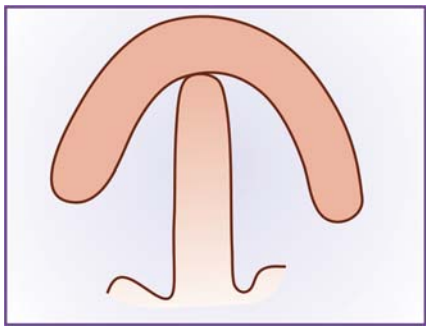

Fig. 22.9B: Repair completed with rotation of flap

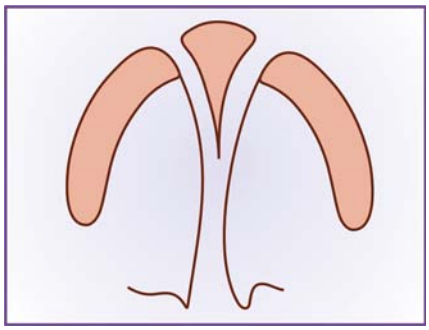

Fig. 22.10A: VY repair of cleft palate-showing the incision line

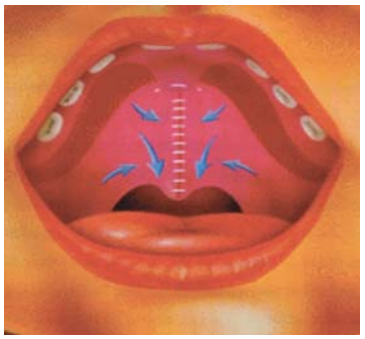

Fig. 22.10B: Repair of the palate in two layers with posterior reposition of flap

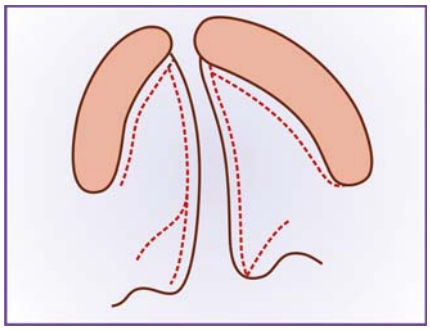

Fig. 22.11A: Furlow's Z-plasty cleft palate repair—showing incision line

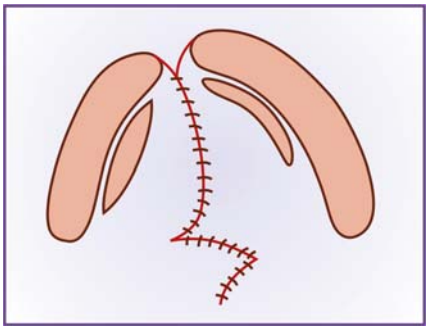

Fig. 22.11B: Mobilization and reconstruction of flap by Z-plasty

The palate develops from the primary palate (pre-palate) and secondary palate (palate). The wedge-shaped primary palate developed from globular process gives rise to parts of the pre-maxilla, nasal tip cartilage, nasal floor, lip, alveolus and triangular-shaped anterior palate. The lack of mesenchymal development of the central or lateral processes leads to different varieties of prepalatal cleft. This is also associated with hypoplasia of the maxillary structure. The structure posterior to incisive foramen gives rise to secondary palate. In a seven-week embryo, palatal process develops from maxillary process, extends from primary palate to tonsilar fossa, and hangs vertically. Between the 8 to 9th weeks palatal shelve rotates from vertical position to horizontal position due to straightening of the neck from flexed position and dropping down of tongue, thereby separating the oral from nasal cavity. The fusion of primary palate and secondary palate takes place in a Y shaped manner and the limbs of Y passes anteriorly between the incisor and canine teeth. The ventral 3/4th of the secondary palate ossified to form the hard palate and fuses with the nasal ceptum. Dorsal 1/4th of the secondary palate does not ossify and hangs like a curtain to form soft palate. The cleft of the palate occurs due to failure of fusion of palatal processes or subsequent breakdown of mesenchymal structures. The clinical sequence of cleft palate, glossoptosis and mandibular hypoplasia as described by Robin is a manifestation of early embryological defect.

Etiology

The etiology of the cleft lip and palate is multifactorial involving both genetic and environmental factors. No single gene has been implicated to the causation of facial cleft. The facial cleft has been associated with varieties of genetic syndrome. Because of syndromic association, it is imperative to search for other congenital anomalies associated with cleft lip and palate specially, in the head and neck. Chromosome abnormality Trisomy D syndrome may cause cleft lip and Wander Woud syndrome a genetic defect is associated with lower lip defect. Experimentally, cleft has been produced in varieties of condition due to deficiency of vitamin A, Folic acid, Pantothenic acid, Riboflavin and Nicotinic acid. Cleft has also been produced by excess of vitamin A, hypoxia and ingestion of various drugs like Nitrogen Mustard, Nucleic Acid Antagonist, Corticosteroid and Irradiation during pregnancy. Maternal smoking and alcoholism have also been implicated for the occurrence of cleft lip and palate. The unilateral cleft lip in males has a higher hereditary background than the incomplete cleft palate, which is more common in females and has a low hereditary background suggesting different causes in the development of cleft lip and palate.

Anatomy of Cleft Lip and Palate

Cleft lip and palates are separate entities. However, cleft lip may be associated with cleft alveolus and cleft palate. Severity of the deformity depends on the abnormal development of median nasal process and maxillary process. In minor degree of cleft lip the deformity, involve the front nasal process. Due to absence of restraining force of orbicularis oris alveolar segment is displaced outwards and pre-maxilla is flaired anteriorly. The alveolar gap varies from mild to severe with varying degrees of collapse of alveolar arch. In bilateral cleft lip the pre-maxilla shows marked protrusion giving a grotesque appearance. The teeth adjacent to the cleft are angled, distorted and lateral incisor may be absent. Nasal tip and

columella are short with flattening of the alar cartilage maxillary hypoplasia. In incomplete unilateral cleft palate, nasal septum (Vomer) is attached to the uncleft side of hard palate. In bilateral complete cleft lip and palate, Vomer is free and septum hangs freely. The musculature of soft palate is distorted. Levator palati muscle is attached to the posterior age of the hard palate instead of being directed towards the midline. Both the tensor and levator palati are attached to the eustachian tube causing malfunctioning of the tube. The cleft palate is occasionally associated with retroposition of tongue and mandibular hypoplasia, thus causing obstruction in the air passage and abnormality in swallowing reflex as described in Peirre Robins sequence.

Clinical Presentation

Cleft lip and palate presents with multiple clinical problems:

1. *Facial deformity* is the immediate concern to the parents and causes psychological problem to the mother. Parent should be properly guided and be assured that the defect in her child is curable.
2. *Sucking and eating* Sucking of breast is not greatly affected in isolated cleft lip deformity as the infant takes the nipple and areola inside the mouth during breast-feeding. However sucking is affected in case of cleft palate as tongue cannot compress the nipple against the cleft palate and negative pressure is not created during sucking. There will be regurgitation of feeds through the cleft palate.
3. *Respiratory obstruction* Isolated cleft palate deformity may cause airway obstruction in presence of Pierre Robins sequence due to the falling back of the tongue and retrognathia and may need immediate interference for oropharyngeal reflex to develop.
4. *Speech and phonation* The complete speech mechanism is ensured by velopharyngeal closure. Voluntary contraction of soft palate aided by tensor and levator muscle compress the soft palate against the nasopharynx and helps in the production of speech. Incomplete velopharyngeal closure is the hallmark of the cleft palate. Nasal intonation is acquired during production of vowel sounds in-patients with velopharyngeal incompetence and consonant sounds are distorted.
5. *Teeth* Alveolar cleft interfere with the development of incisor and canine teeth. The incisor may be absent or even duplicated. Maxilla is hypoplastic and smaller and alveolus on the lateral side is at a lower level than the medial segment. Teeth on the maxillary side becomes crowded and there may be occlusion difficulties due to mandibular prognathism.
6. *Respiratory tract* Nasal tip is depressed and columella is short in cleft lip. Baby suffers from recurrent upper respiratory tract infection due to the nasal regurgitation. Otitis media is common due to the malfunctioning of eustachian tube and hearing may be affected.

Management

The aim of treatment of cleft lip and palate is to achieve

a. Normal appearance
b. Normal swallowing of feeds without regurgitation
c. Free airway passage
d. Normal phonation and
e. Alignment of teeth.

The general care should be started in neonatal period to achieve the goal.

Neonatal Care

Feeding

There is not much problems of feeding in babies with cleft lip though parents are worried about it. Feeding in a child with cleft palate is a definite problem as infant is unable to suck properly due to the palatal gap and there is regurgitation of feeds during swallowing. However, the feeding can be maintained if milk is delivered at posterior part of the oral cavity by specially created artificial nipple or spoon. Special type of feeding bottle or plastic bottle can be squeezed to deliver the food at the back of the oral cavity. Baby also is to be held in 450 to prevent regurgitation of feed.

An orthodontist who can prepare a plate to cover the gap in the palate, which helps in facilitating the feeding, should examine the baby. The base plate can be secured in position to help in the growth of the hard palate. Apart from this intra, oral or extra oral orthodontic appliances will be of great help to mould the growth of alveolus and maxilla. Elastic head cap traction with elastic strapping for the projecting premaxilla is of utmost important procedure in new born period. This makes the lip repair easy by decreasing the gap between the lip and alveolus. The dynamic

palatal appliances are also sometimes required for the expansion of the collapse maxillary arches. Care should be taken to secure free air-passage in case of Pierre Robins sequence where glossoptosis impeded the swallowing reflex and causes airway obstruction. Specialized surgical technique may be required to keep the tongue anterior and to prevent the falling back the tongue.

Surgical Timing

Cleft lip is traditionally repaired during 3 to 4 months of age. However, the lip is repaired after birth in some centers. Rule of 10's is a good guide for the lip repair-10 weeks of age, 10 gram of hemoglobin and 10 pounds of weight. This conditions favour safe anesthesia, good wound healing, and the other congenital anomalies in child can be detected by this time. In unilateral cleft lip and palate with wide gap, lip adhesion and simultaneous closure of soft palate is being practiced in some centers between 6 to 8 weeks of age. Definitive lip repair is done around 6 to 8 months. Cleft palate is usually repaired between 6 months to 18 months depending on the growth of the baby and surgeons choice. Early repair seems to be results in better speech outcome. However, repair may be delayed in babies with respiratory problems. Majority of cleft alveolus is repaired during cleft lip repair taking mucoperiosteum flap from medial side. Wide alveolar gap may require bone graft between 5 to 6 years of age. The anterior segment of the cleft palate is usually repaired along with the repair of the cleft lip.

Preoperative Preparation

Elective surgical procedure is undertaken when the child is free from respiratory infection and attains a good health. The upper respiratory infection is controlled before the repair. A complete blood count, Prothrombin times are routinely done before operation. Culture from nasopharynx is carried out in case of repeated respiratory tract infections. Blood grouping and cross-matching is done before the repair of the cleft palate.

Anesthesia

A safe endotracheal general anesthesia is a prerequisite of repair of cleft lip and palate. This helps in better closure and reduces the postoperative complications. Monitoring is done by electrocardiogram and pulse oxymeter. The assay of Carbon dioxide in expired air is of added advantage. The specially designed angled endotracheal tube (RAE Tube) is fixed in the midline of the chin and it facilitates the introduction of mouth gag.

Surgery

Cleft Lip Repair

The numerous techniques have been evolved to repair the cleft lip. Early technique involves straight-line closure. However, the modern repair involves the use of lateral flap to fill the medial deficit. Lateral quadrilateral flap of Le Mesurier or Tennison's triangular flap introduce tissue in the lower medial part to produce a pouting tubercle. However Millard in 1955 described an advancement technique in which lateral flap is advanced in upper medial portion with rotation of the medial segment (Figure). It preserves the philtrum and cupids bow. This technique is easy and adjustment can be made during the repair and collumelar lengthening is appropriate, the tissue loss is minimum and scar is less promonent. In this technique emphasis has also been given to the mobilisation of the alar cartilage and repair of the base of the nose. In recent technique of repair of cleft lip emphasis has also been changed from design of flap to mobilisation and accurate functional closure of orbicularies oris muscle and skin is closed by Z plasty to avoid vertical closure. The critical factors for evaluating the success of the unilateral complete cleft lip repair are position of the alveolar segment and vertical height of the lateral lip segment. The pre-surgical palatal expansion device is required in case of wide-collapse alveolus. The alveolar cleft is repaired by mobilisation of the mucoperiosteal flap from medial segment. Associated anterior cleft palate is repaired during the repair of cleft lip. The nasal deformity is corrected mobilising the alar cartilage depending on the severity of the deformity.

Bilateral cleft lip repair involves multiple problems of the shortening of the columella, protrusion of premaxilla and exflair of alar cartilage, which make the lip repair different from unilateral cleft lip repair. Decision regarding the staged repair or bilateral repair in one sitting depending on the columellar length, protrusion of premaxilla and alveolar gap. Millard rotation flap augment the central prolabial vermillion. Recent technique concentrates on using the entire

prolabium for central position. The Millard technique or modified Manchester technique (Straight line closure) can be used satisfactorily if the bilateral closure is contemplated. The alveolar closure and repair of the base of the nostril is done concurrently. In case of short columella, lengthening of columella is undertaken by V-Y Plasty at a later period.

Repair of Cleft Palate

Controversies exist in the surgical treatment of the cleft palate repair regarding timing and technique of staged versus complete repair. Early repair has a better influence on the speech and skeletal deformities. The basic goal of treatment is muscular closure of soft palate and closure of gap in the hard palate. This can be achieved by side-to-side closure across the cleft in two layers by mobilizing the mucoperiostial flap and relaxation incision along the alveolar margin to release the tension in the suture line. The time old technique of Von Langenbeck is a straightforward closure but adequate palatal lengthening is not achieved. To achieve the lengthening of the palate oblique anterior incisions are made on both side of the alveolar groove and mucoperiosteal flaps are mobilised from the hard palate, the levator muscles are separated from free age of hard palate and the muscles are closed in the midline. The palatal flaps are pushed back and repaired in V-Y arrangement. This technique of Veau-Wardill Kilner repair helps in achieving the length of the short palate. The addition of Z plasty in the short palate helps in the gain of additional length. Two Z plasties described by Furlow are made in the oral and nasal side of the muscular and mucus tissue. The palatal length is gained with the reconstitution of muscle and mucosa of the soft palate. In huge gap the palate can be repaired taking flap from the tongue and Buccal mucosal flap.

Secondary Surgery

Alveolar Gap

The alveolar gap is generally repaired concurrently with the cleft lip repair. But in case of huge gap bone, grafting is required to fill up the gap. The autologus bone graft (Rib) or costal cartilage is undertaken at five to six years of age. This procedure helps in the closure of residual oronasal fistula and provides support for the subsequent eruption of teeth.

Lip and Nose

In spite of different methods of techniques of the repair of cleft lip revisional surgery is required for scar contracture, vermillion realignment, philtrum lengthening. Depressed nasal tip can be corrected by cartilage graft. columellar lengthening can be done by V-Y plasty in cases of short columella.

Palatal Revision

The incidence of post-operative fistula is very high 10 percent to 20 percent even in experienced hands. The common site of fistula formation is anteriorly at the junction with the pre-maxilla and posteriorly at the junction of the soft and hard palate. Different local flaps are created to close the fistula. However, buccal mucosal flap or other distant flaps may be used depending on the site and size of the fistula. In cases of short palate with velopharyngeal incompetence baby suffers from nasal intonation. Musculomucosal flaps are taken from the posterior pharyngeal wall to lengthen the palate and to diminished the nasopharyngeal openings. This pharyngeal flaps can be taken either superiorly or inferiorly based to repair with the posterior palatal margin. This technique is improved the nasopharyngeal incompetence and diminished the air-leak via the nasopharyngeal openings.

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TWENTY-THREE

Dental Emergencies

• Emergency Drugs • Emergency Kits • Various Emergencies

The medicine, which are used as emergency drugs are as follows.

- Therapeutic oxygen
- Nitrous oxide (very useful analgesic following MI)
- Adrenaline injection (1:1000 or 1 mg/1 ml)
- Hydrocortisone injection (100 mg), injection decadron
- Antihistamine tablets and injection (e.g. injection avil)
- Diazepam 5 mg/10 mg (injection valium)
- Flumazenil injection (100 ug/ml.)
- Glucose (50% solution) for injection, and powder for oral use
- Glucagons injection (ideally) 1 mg
- Atropine injection (100 ug/ml)
- Colloid solution for infusion (e.g. Haemaccel, plasma expander blood substitute)

Emergency Kits

- Portable defibrillator (incorporating ECG print-out)
- Portable oxygen delivery system
- Ambu bag (self-inflating with valve and mask)
- Oropharyngeal airways (sizes 1,2 and 3)
- Cricothyroid puncture needless
- High volume aspiration with suction catheters and Yankauer sucker
- Disposable syringes (2,5,10 and 20 ml sizes)
- Needles (19,21, and 23 gauge) and butterflies
- Tourniquet, sphygmomanometer and stethoscope
- Venous access cannulae ('venflons' 16 and 22 gauge)
- IV infusion sets
- 'BM sticks' (for rapid assessment of blood sugar levels).

The emergencies may initiate during dental procedure. The various emergencies may have to be faced summarized as below:

Syncope: Factors responsible are:

- Anxiety
- Pain
- Injection
- Fatigue
- Empty stomach

Clinical features include pale, perspiration, moist skin, dizziness, weakness or nausea and gradually loss of consciousness.

Preventive treatment includes assurance, diazepam 5 mg half an hour before surgery and on the night before the surgery.

- *Therapeutic measures* supine position of the patient flashing the face with cold water.
- Therapeutic oxygen at 10 L flow/min.
- Administer spirits of ammonia.
- Monitor and record vital signs.
- Reassure patient.

In case of low blood pressure and pulse start 5 percent dextrose and lactated Ringer's by intervenous route.

Administered a vasopressor epinephrine 0.3 to 0.5 mg. SC/IM route. In case of slow pulse < 60 beats per minute administer 0.4 mg. atropine IV route to increase heart rate.

Cardiac Arrest

Sudden loss consciousness and absence of arterial pulse (the carotid arterial pulse) with avascular surgical field, dialated pupils with cyonosis.

Management includes inform immediate for emergency support. Establishment of airway inflates lungs with mouth-to-mouth resuscitation. If carotid pulse is absent compress sternum 1 to 2 inches (2 – 3) finger widths above xiphoid process.

In case of low blood pressure and pulse start 5 percent dextrose and lactated Ringer's by intervenous route.

Administered a vasopressor epinephrine 0.5 to 1 ml. 1:1 thousand is may be repeated every 5 minute. In case of slow pulse < 60 beats per minute administer 0.5 mg may be repeated every 5 minute atropine IV route to increase heart rate.

Medical emergency consultancy absolutely mandatory to combat to above mentioned acute problems.

The problems or emergency and management related to bleeding as well as various shock already discussed in detail in Hemorrhage and Shock chapters.

Collapse of diabetic patient in dental chair maybe due to hyper glycaemia (excess sugar in the blood or hypo glycaemia less sugar in the blood). These two features represent by the following signs and symptoms:

Hyperglycemia	*Hypoglycemia*
Blood sugar high	Blood sugar low
Slow onset	Rapid onset
Drowsy and disorientated	Aggressive behaviour
Dry skin	Moist skin
Deep, laboured breathing	Normal or rapid breathing

Usually, the diabetic patient have often severe artherosclerosis and consequently prone to IHD. The collapse may be due to a myocardial perspective. Hyperglycemia may result form excessive insulin consumption or a missing a meal associated with excitement and anxiety attending the dentist, stress or changing insulin requirements due to dental infection.

Management includes:

- The conscious administer oral glucose
- The supine position of the patient.
- If unconscious and uncooperative
- Obtain venous access
- Administer 50 ml of glucose IV or 1 mg glucagons IM
- Urgent transfer to hospital.

Acute chest pain: This is usually mhyocardial (but exclude collapsed lung or pulmonary embolus).

Differential diagnosis:

- Angina pectoris
- Myocardial infarction (MI).

Symptoms and signs:

- Severe, crushing retrosternal pain ('heavy, crushing or constricting')
- Radiations to arm, neck or jaw
- Angina normally relieved by GTN tablet or spray
- Myocardial infarction likely if breathlessness, nausea, vomiting, loss of consciousness, weak/irregular pulse and hypotension accompany pain.

Management

- Give patient's own antiangina medication, e.g. GTN spray or tablet sublingually
- Wait 3 minutes and repeat if necessary, then assume MI.
- Send emergency message for medical assistance
- Do not lie flat as this increases feelings of breathlessness and panic
- Administer nitrous oxide and oxygen (50/50) as pain relief
- Obtain venous access in case CPR is required
- Establish verbal encouragement of patient
- Administer oral aspirin (one tablet) as anti-platelet agent
- Urgent transfer to hospital.

Asthma: Predisposing factors are anxiety, tension. The respiratory tract hyper reactivity consequently bronchospasm.

Clinical features dyspnea, wheezing, panic and fear, restless with inability to speak.

Management

- Give reassurance but do not crowd the patient
- Allow the patient to use his/her own inhaler or supply a salbutamol inhaler
- The patient should assume the most comfortable position (usually erect)
- Give nebulized salbutamol (2.5 mg) if a portable nebuliser is available. Otherwise use high flow oxygen and deliver sulbutamol (6 – 8 actuations) into the oxygen mask and allow the patient to breathe this mixture
- Continue high flow oxygen and repeat the above
- Obtain IV access and give hydrocortisone 100 to 200 mg IV
- Urgent transfer to hospital.

Adrenal crises may be initiated during surgical procedure in those patients are not covered prophylactic corticosteroides is not given. It is usually seen the long-term steroid users in case of asthma rheumatic disease and inflammatory bowel disease.

The clinical features include pallor of skin, rapid with pulse, low blood pressure and subsequently rapid loss consciousness.

Management includes preventive, prophylaxis steroid.

Therapeutic supine position and raise the legs.

Therapeutic oxygen with steady flow.

Injection decadron IV urgent transfer to hospital and assess for other cause of collapse. Example – myocardial infraction.

Epilepsy may present by various forms. A properly controlled patient with epilepsy does not create problems to the dental surgeon.

Predisposing factors includes stress, anxiety, fasting, hypoglycemia and fainting and all cause a fit in the surgery.

Tonic-clonic seizures are often preceded by an aura, followed rapidly by loss of consciousness and a rigid, extended body (tonic phase) and jerking or flailing movements (clonic phase). Postictal drowsiness and the desire to sleep follow. Most fits last less than 5 minutes and require no intervention except protecting the patient from self-inflicted damage. Where the fit is prolonged or repeated, status epilepticus results and intervention is required to prevent brain hypoxia.

Management

- Injection Diazepam 10 to 20 mg IV
- Therapeutic oxygen with high flow
- Check blood sugar
- Urgent transfer to hospital.

Accidental inhalation of foreign bodies: In supine dentistry inhaled foreign bodies are hazard problems. The precautions and preventive measures may avoid these problems. The simple coughing does not dislodge the offending article. The *Heimlich maneuver* helps the problems, the patient is encircled by your arms from behind at the level of the lower border of the rib cage; a sudden forceful squeeze is exerted by pulling your arms together with the hands directed upwards towards the chest. With small children, swinging the patient around by the legs may be sufficient to dislodge the article.

Where the article is lying at the laryngeal inlet, a cricothyrotomy may allow breathing until the obstruction can be physically dislodge. In all cases, a follow-up chest X-ray is mandatory.

TWENTY-FOUR

AIDS and Oral Surgery

• Etiology of AIDS • Dental Importance and Consequences • Oral Manifestations of AIDS

ACQUIRED IMMUNODEFICIENCY SYNDROME (AIDS)

Etiology

Retrovirus identified as the human T lymphotropic virus III (HTLV – III).

DENTAL IMPORTANCE AND CONSEQUENCES

- Bleeding tendency
- Breathing difficulty
- Inhalation anesthesia risk.

Causes of Consequences

1. Some patients with AIDS experience idiopathic thrombocytopenic purpura.
2. Dyspnea evolves as a consequence of chronic pneumocystis pneumonia and may pose a risk for inhalation anesthesia.

The oral manifestations of AIDS are summarized as follows:

Group I: Lesions strongly associated with HIV infection.
Group II: Lesions less-commonly associated with HIV infection.
Group III: Lesions seen in HIV infection.

Group I

Candidosis: Varieties available – erythematous; pseudomembranous, angular cheilitis, median rhomboid glossitis.

Hairy leukoplakia: Kaposi's sarcoma, non-Hodgkin's lymphoma.

Periodontal disease: Liner gingival erythema, acute necrotizing ulcerative gingivitis, acute necrotizing ulcerative periodontitis.

Group II

Atypical ulceration: HIV associated salivary gland disease (HIV-SGD); Xerostomia and/or swelling of the major salivary glands; necrotizing ulcerative stomatitis; thrombocytopenic purpura.

Viral infections: Cytomegalovirus; Herpes simplex virus; Human papillomavirus; Varicella zoster.

Group III

Bacterial infection: Drug reactions, Fungal infections.

Neurological disturbances: Facial nerve palsy, trigeminal neuropathy.

Laboratory Investigation

The enzyme-linked immunosorbent assay (ELISA Test).

Western blot analysis.

Erythematous and Pseudomembranous Candidosis

Most commonest oral fungal infection with all the features present association with HIV infection. Erythematous candidosis seen early in the disease process whereas pseudomembranous candidosis seen in later stage when immunodepression is severe. Both forms are highly predictive of the development of AIDS.

Hairy leukoplakia: Usually asymptomatic characterized by bilateral vertically corrugated white patches on the lateral margins on the term. It is considered to be pathognomonic of HIV infection.

Diagnostic features include detection of presence of EBV within the lesional tissues by in situ hybridization.

Koposi's sarcoma: KS is mainly seen in the elderly person almost exclusively in male homosexuals and

rare for among other risk categories for HIV infection. Presents as rate or purple maculopopular lesions. Commonest site the junction of hard and soft palate. KS is usually very responsive to radiotherapy alternative measures includes chemotherapy (systemic and interlesional), surgical excision and laser cryosurgery.

Non-Hodgkin's lymphoma: Uncommon may present as rapidly enlarging, firm rubbery lump. Intraoral sites include fauces, palate and gingivae. Lesions maybe ulcerated associated with destruction of tooth support.

Treatment includes radiotherapy and chemotherapy.

Liner gingival erythema: Characterized by an intense linear band of erythema along the gingival margin, which may also extend onto the attached gingivae. Severity of inflammation is out of proportion to the state of oral hygiene. Spontaneous gingival bleeding may also be a feature.

Acute necrotizing ulcerative gingivitis: Characterized by gingival pain, bleeding on probing or spontaneous bleeding and interdental ulceration with craterlike defects.

Acute necrotizing periodontitis: Rapid localized or generalized periodontal destruction with severe pain, bone loss, tooth mobility and periodontal pocketing.

HIV salivary gland disease: More common in HIV infected children than adults. Characterized by xerostomia and/or swelling of the major salivary glands. Clinical parallels with Sjögren's syndrome although characteristic autoantibody profile is lacking. Histological features similar to Sjögren's syndrome.

Some important surgical dictum for treating HIV patient in oral surgical clinic:

1. Consult and clearance from medical specialist prior to surgery.
2. Keep the patient last of the list in case of minor oral surgery.
3. In case of major surgery keep the patient without any appointment to other patients on that particular date.
4. Careful about use of sharp instrument, disposable needle and syringe, suture needle with thread and SS Wire for wiring.
5. Careful about destruction of disposable gauge, cotton, syringe, needle, blade, sucker tube and disinfection of oral surgical room.
6. Operator as well as assistant careful about precautionary measures during and after treating this sort of patient.

TWENTY-FIVE

Maxillofacial Trauma and Management

• Introduction • Healing of Jaw Fractures • Maxillofacial Injuries • Maxillofacial Trauma • Complication of Maxillofacial Injuries • Dentoalveolar Injuries • Mandibular Fractures • Condylar Fractures • Fracture of Zygomatic Complex • Mid-face Injury Including the Middle-Third Fractures of the Facial Skeleton • Fracture of Nasal Bone and Nasoethmoidal Injuries • Blowout Fractures • Superior Orbital Fissure Syndrome

INTRODUCTION

Fracture may be defined as breach of continuity of bone due to trauma or injury, which may be incomplete or complete. Difference between facial bone fracture and other bones of human skeleton in three important parts:

1. Risk to the airway—directly compromised.
2. Presence of teeth, which helps the stabilizing, fractures.
3. Excellent vascular supply of facial bones, which promotes rapid healing.

The facial bone may be divided into three parts:

a. Lower-third mandible,
b. Middle-third maxilla and allied bones, and
c. Upper-third, frontal, temporal and parietal bones.

Previously, the oral surgical trauma pertaining to middle-third and the lower-third of the facial skeleton. But after the reported study of Pape K of Germany of extended Lefort fracture drew attention to the problem associated with anterior cranium. Downward displacement of the frontal bone precludes adequate reduction of the middle-third of the face. The frontal bone and orbital roof must then be reduced prior to reduction of the facial bone. The extended Lefort fracture exposed via coronal scalp flap (cited from Peter Bank).

The displacement of the fracture will depends on:

a. Degree and direction of force.
b. Point of impact.
c. Type of injury—blunt or sharp.
d. Muscular pull—particularly important in the mandibular fracture.
e. Presence or absence of teeth in both fragments.

HEALING OF JAW FRACTURES

Bleeding at the site of fracture → formation of hematoma → formation of clot → formation of fibrous tissue → the broken ends of the bone are united by the collagenous fibers called fibrous or temporary callous → immature callous replace by the mature callous known as secondary callous → in secondary callous transform into bone or osteoid tissues → the excess bone is reabsorbed and the normal outline achieve, the process known as remodeling.

Factors which Delay Healing

Local

- Infection
- Foreign bodies
- Mobility
- Poor vascularity – irradiation.

Systemic

- Increasing age
- Disease, e.g. diabetes
- Deficiency, e.g. malnutrition.

Applied Surgical Anatomy

We have already discussed the face is divided into three parts—lower-third is the mandible and the muscles and the soft tissue which covered. The middle-third is bounded below the occlusal line of the maxillary teeth and above by a line drawn through the pupils of the eye. The upper-third lies above.

The mandible or the lower-third of the facial skeleton, prone to fracture sites are the condylar neck,

the angle the canine region. The condyle may fracture via thin neck either within the capsule or outside the capsule. It maybe unilateral or bilateral. Fractures of the coronoid process are most uncommonly seen.

The angle of the mandible is a weak part because there is a change in direction of the grain of the bone which occurs where the vertical ascending ramous and the horizontal body meets. The impacted third molar may occupied two-thirds of the depth of the bone.

The body is the strongest part of the mandible but is weakened by the presence of the tooth alveolar socket of which the canine is elongated root and the socket is very prone to fracture.

Middle-third of the facial skeleton composed of various bones of which includes:

a. Two maxillae.
b. Two zygomatic bones.
c. Two zygomatic process of temporal bones.
d. Two palatine bones.
e. Two nasal bones.
f. Two lacrimal bones.
g. The vomer.
h. The ethmoid and its attached conchae.
i. Two inferior conchae.
j. Pterygoid plates of the sphenoid.

The spaces between the buttresses are closed by thin bone plates which enclose several large cavities, the maxillary air sinuses, the nasal cavity, and the orbits. The base of the complex is strengthened by the alveolar bone the plate. These varieties of construction provide resistance to upper force but very little stress to combat from a horizontal blow.

Clinical Features of the Maxillofacial Injuries

Etiology

a. Assaults—most common in western society.
b. Road traffic accidents—most common in developing nations.
c. Sports injuries.
d. Falls.
e. Industrial accidents.

Predisposing Factors

a. Alcohol.
b. Epilepsy.
c. Bone pathology, e.g. cysts, tumors.

Presentation

a. Pain.
b. Swelling.
c. Tender on palpation. Loss of function, e.g. trismus, limited eye movement causing double vision.
d. Malocclusion.
e. Altered sensation – nerve damage.

Background

a. Time of injury.
b. Mode of injury.
c. Loss of consciousness.
d. Treatment prior to admission.

Medical History

a. Allergies.
b. Drugs, e.g., insulin, steroids, anticoagulants.
c. Illnesses—past and present.
d. Previous surgery.
e. Smoking and alcohol intake.

General Assessment

a. Airway.
b. Shock.
c. Hemorrhage.
d. Level of consciousness.
e. Overt infection.

Clinical Examination

a. Lacerations.
b. Swelling.
c. Ecchymosis.
d. Visible or palpable deformity.
e. Abnormal mobility and crepitus.
f. Palpable tenderness.
g. Impaired function, e.g. trismus, diplopia.
h. Malocclusion.
i. Nerve injury.

Radiographic Investigations of Maxillofacial Injuries

Plain X-rays must be taken in at least two planes at right angles to each other.

Standard Projections

Orbits and antra–occipitomental 15 and 30 degrees.

Maxillary Bones

- Occipitomental 15 and 30 degrees
- Lateral skull.

Zygomatic/Malar Bones

- Occipitomental 15 and 30 degrees
- Submento-vertex.

Mandible

- Posteroanterior of mandible
- Orthopantomogram
- Right and left lateral obliques.

Frontal Bones

- Occipitomental 15 and 30 degrees
- Lateral skull
- Brow-up lateral skull.

Other Projections Sometimes Used

- Dental/intraoral films
- Tangential skull views—soft tissues for emphysema or a foreign body—depressed fractures
- Transcranial and transpharyngeal views of temporomandibular joint
- CT scans—complex midface fracture, e.g. naso-ethmoidal fractures—three dimensional reconstruction, coronal views for blowout fractures.

Other Important X-rays

- Cervical spine—to show fractures: Lateral, Transoral view of odontoid pet
- Chest—for chest injury or aspiration: Postero–anterior, lateral.

Principles of Management

Immediate Intervention

a. Establish and maintain airway with care of cervical spine.
b. Establish the patient breathing, if necessary intubate oxygen.
c. Control arrest bleeding, management of consequence of bleeding and trauma (shock if present).
d. Examination of injuries if possible temporary immobilization of suspected fracture.
e. Prophylaxis control of infection by suitable antibiotics and relief of pain (avoid suggestion).

Treatment Priorities Includes the Above in Addition to

a. Relief respiratory obstruction.
b. Cardiac arrest.
c. Control of massive bleeding if present.

Treatment Require Urgently

a. Intra-abdominal bleeding.
b. Head injuries-significant head injuries, deterioration.
c. Chest injuries.
d. Compound fractures of limbs.

TREATMENT THAT CAN WAIT: MAXILLOFACIAL TRAUMA

Treatment of Soft Tissue Injuries

a. Tetanus prophylaxis.
b. Antibiotics.
c. Irrigation with normal saline or povidone iodine solution.
d. Debridement—careful removal of severely contused tissue and foreign bodies.
e. Haemostasis (local application of styptic solution).
f. Primary closure—infiltrate local anesthetic solution via the wound and then accurately approximate freshened wound edges with careful suturing to minimize scarring.
g. Skin loss—avoid secondary healing of facial wounds: 1) Undermine skin edges and advance; 2) Skin grafts; 3) Local flaps; 4) Suture skin to oral mucosa – gunshot wounds.

GENERAL PRINCIPLES OF FRACTURE TREATMENT

a. Debridement
b. Reduction:
    1. Closed manipulation
    2. Traction
    3. Open reduction.
c. Fixation:
    1. External:
        i. External pin fixation
        ii. Halo frames
    2. Internal:
        i. Non-rigid: suspension wiring; circum-mandibular wiring; transosseous wiring; intramedullary pins
        ii. Rigid: adaptational—plates or bicortical screws; compression—plates or lag screws

d. Immobilization: Intermaxillary fixation.
e. Functional rehabilitation.

Specific Injuries Requiring Specialist Attention

a. Eyes and eyelids.
b. Nasolacrimal apparatus—severed ends must be realigned and splinted internally with fine silastic tubing.
c. Parotid duct—alignment and suturing.
d. Facial nerve—repair in case of proximal injuries.
e. Bites—human bites have high infection rates and should only be loosely sutured.
f. Gunpowder and grease injuries.

COMPLICATION OF MAXILLOFACIAL INJURIES

Problems Related to Healing of Fracture

Mal union: Mal position of fracture fragments due to inadequate reduction and fixation.

Management may need osteotomy in future to correct.

Delayed union: Disturb and prolong healing process, example, resulting from localized and systemic factors.

Non-union: No bony healing at all.

COMPROMISED AIRWAY

Causes

a. Inability to open the mouth.
b. Gross edema of the tongue and the floor of the mouth.
c. IMF.
d. Lying on back—allows tongue to obstruct oropharynx.
e. Aspirate loose debris and tooth fragments if any.
f. Blocked nasal and oropharyngeal tubes.

Management of Compromised Airways

a. Patient positioning:
   1. Conscious—sitting up and leaning forwards.
   2. Unconscious—recovery position with chin lift.
b. Airways—oropharyngeal or nasopharyngeal tubes.
c. Endotracheal tube.
d. Cricothyroidotomy—for complete airway obstruction.
e. Tracheostomy—especially with chest and head injuries.

Infection

Causes of Fracture Site Infection

a. Compound injury.
b. Foreign bodies.
c. Devitalized teeth.
d. Pre-existing oral infection—e.g. diabetes, steroids, anemia.
e. Radiotherapy—previous treatment.

The role antibiotic therapy in maxillofacial injuries as follows:

a. Intraoral breach—Amoxycillin and metronidazole.
b. Involvement of skin cephalosporin, in case of local application needed for the skin, soframycin ointment or nebasulf powder maybe used.
c. In case of contaminated wound—Amoxycillin and metronidazole.
d. CSF leak-antibiotic which crosses blood—brain barrier includes sulphadimidine, septran and cephalosporin.

Dentoalveolar Injuries

Predisposing Factors

a. Trauma.
b. Fall mainly in the stair case of the village ponds due to slippage.
c. Accidental injury to the chin by the tube well handle.
d. Females are affected more than the male.
e. Inter personal violence.
f. Cycling.
g. Epiletic and handicapped patient.

Classification

Ellis classified dentoalveolar injury involving tooth or teeth.

Class – I fracture: A fracture of only the enamel cap of the crown of the tooth.

Management: Enameloplasty and/or bonding.

Class – II fracture: An injury extending into the dentine but with no exposure of the pulp.

Management: Dentin coverage with calcium hydroxide and bonded restoration or reattachment of fractured segment.

Class – III fracture: An extensive injury to the coronal portion of the tooth with a pulp exposure.

Management: Pulp therapy via pulp capping or partial pulpotomy.

Class – IV fracture: A fracture occurring at or below the cementoenamel junction of the tooth.

Management: If the fracture is supragingival, remove the coronal segment and perform appropriate pulp therapy, then restore. If the fracture is subgingival, remove the coronal segment and perform appropriate pulp therapy, the reposition the remaining tooth structure coronally either orthodontically or surgically. The surgical approach results in loss of pulpal vitality and therefore requires a pulpectomy.

Haily classified the changes of the tooth within the socket and its surroundings, which again modified by George Dimitroulis on the basis of impact of injury.

Haily classified the traumatic displacement of a tooth from the socket

a. Luxated that means the tooth has been loosened and move.
b. Avulsion means the tooth has been displaced from the apical region from the socket towards occlusal plane.
c. Intrusion -tooth has been intruded into the alveolus d.
d. Exfoliation that mean tooth totally removed from the socket.

Dimitroulis Summarized the Injuries as

a. Concussion—compression injury to periodontal membrane with tooth retained in original position.
b. Subluxation—tooth partially displaced from socket without injury to socket walls.
c. Displacement—tooth partially displaced from socket with associated injury to alveolar walls.
d. Avulsion—complete loss of tooth from socket.

However, above classification is the recent one but present author prefer Haily classification cited from Kruger substantive and transparent.

The alveolar bone injuries, which includes crushing, or compression associated with tooth displacement and fracture alveolus. The injuries to the gingiva include contusion, abrasion and laceration.

Clinical features: Tooth sensitive to hot and cold; bleeding; mobility of tooth or teeth with fracture of tooth and alveolar bone; mal position of the tooth and bony fragments.

Investigation includes X-rays—periapical occlusal, OPG, examination of soft tissue particularly lips to see any foreign bodies, tooth fragments.

Chest X-ray includes any aspirated tooth or tooth fragments.

Management includes stabilizing tooth or teeth along with the alveolar bone by splint or periodontal wiring.

Control of bleeding by sutures.

Relief of pain by suitable analgesic anti inflammatory usually injection Voveran, IM Stat and suitable antibiotic for prevent infection specially Amoxycillin 500 mg. three times daily, Metronidazole 400 mg. two times daily for five to seven days.

Suitable antiseptic mouthwash specially chlorhexdine after each semi solid meal.

In case of the fracture tooth and teeth and exfoliated alveolar socket and the dentoalveolar fragments totally detached from the surrounding it is better to remove the fragments along with the teeth.

Trimming of the bone and toileting of the wound and placement of sutures followed by the above-mentioned medicine.

Mandibular Fractures: Surgical anatomy already discussed in previous chapter.

Classification of Mandibular Fracture on the Basis of Anatomical Consideration (Fig. 25.1)

Condylar neck	35%
Angle	20%
Body	20%
Parasymphysis	13%
Symphasis	11%
Coronoid	1%

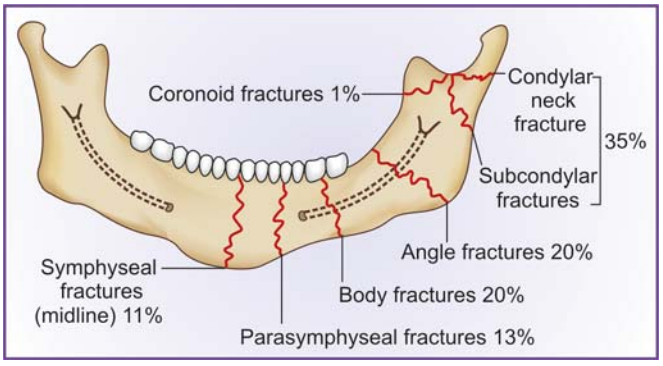

Fig. 25.1: Various types of mandibular fractures

Rowe and Killey also classified on the basis of anatomical location

a. Fractures not involving the basal bone – are termed as dentoalveolar fractures.
b. Fractures involving the basal bone of the mandible. Subdivided into following:
   i. Single unilateral.
   ii. Double unilateral.
   iii. Bilateral.
   iv. Multiple.

Kruger classification of mandibular fracture: Simple or closed. The linear fracture which does not have communication with the external surface. It may or may not be displaced. Fracture of the condyle, coronoid process, ascending ramous are the examples of these categories.

Compound or open: This fracture has communication with external surface via the mucosa, periodontal membrane and the skin. All the fractures involving the tooth bearing area of the mandible belongs to these categories. There is extraoral and intraoral wound is present.

Comminuted: A fracture in which the bone is crushed or shattered into multiple pieces. The high velocity impact usually gun shot wound or missile injury.

Complicated or complex: The fractures associated with the damage to the important vital structures which may be involvement of the nerves of mandible and the facial skeleton and the facial vessels, condylar fractures with involvement to middle cranial fossa.

Impacted: Rarely seen in the mandible.

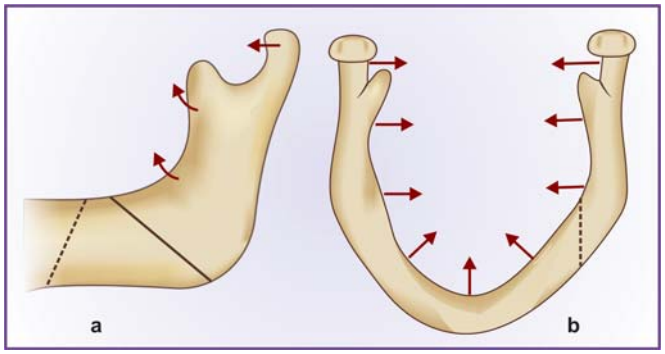

Fig. 25.2: Effects of muscle pull for mandibular fracture. Arrows indicate the direction of the muscle pull.
(a) Horizontal view of mandible showing horizontally-favorable fracture (dotted line) and horizontally-unfavorable fracture (continuous line). (b) Vertical view showing vertically-favorable (dotted line) and unfavorable (continuous line) fractures

Greenstick fracture: A fracture in which one cortex of the bone is broken with the other cortex being bent. It is an incomplete fracture seen in the children.

Pathological fracture: Spontaneous fracture of the mandible result from mild injury due to pathological disease process.

On the basis of potential injury to the mandible classified as

a. Horizontally-favorable or unfavorable.
b. Vertically-favorable or unfavorable (Fig. 25.2).

LINDAHL, 1977 CLASSIFIED THE CONDYLAR FRACTURES (Fig. 25.3)

A. Fracture Level (Fig. 25.3)

The three levels at which fracture of the mandibular condyle may be seen:

1. Condylar head (intracapsular), which maybe vertical, compression, and comminuted.
2. Condylar neck.
3. Subcondylar that means below the condyle.

B. Relation of Condyle to Mandible

1. Non-displaced—linear fracture.
2. Deviated.
3. Displaced maybe medial or lateral overlapping.
4. Anterior/posterior overlapping.
5. No bony contact.

C. Relation of Condyle to Glenoid Fossa of Temporal Bone

1. Non-displaced.
2. Displaced—condylar head still related to glenoid fossa.

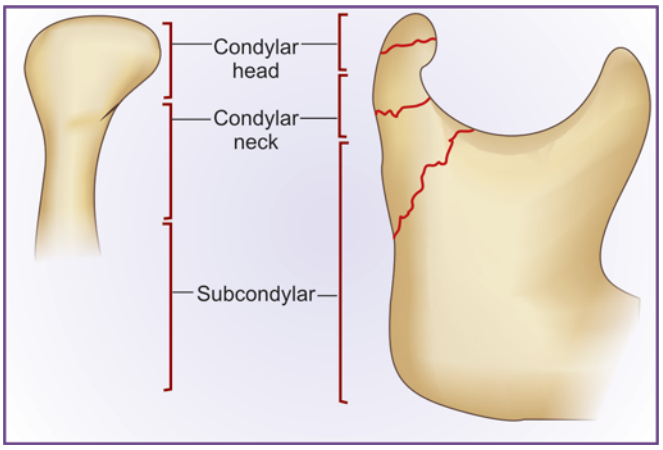

Fig. 25.3: Fracture level

3. Dislocation—condylar head completely out of glenoid fossa and lies anteromedial.

Clinical Features

Fracture Unilateral Condyle

Affected side

a. Pain in joint, worse of movement.
b. Tenderness on palpation and swelling.
c. Absence (or abnormality) of movements of the condyler head.
d. Deviation of the mandible towards this side.
e. Gagging of molar teeth.

Opposite side

a. Open-bite.
b. Limitation of lateral excursion to that side.

Clinical Features of Fracture Bilateral Condyle

a. Pain.
b. Tender of palpation and swelling over the both TM Joint areas.
c. Posterior teeth gagging and an anterior open bite.
d. Restricted lateral movements.
e. Absence of movement of condyle heads.

1. Temporomandibular joint effusion/hemarthrosis
   a. Ipsilateral posterior open-bite.
   b. Middle shift to contralateral side.
2. Unilateral fracture
   a. Ipsilateral premature contact posteriorly.
   b. Ipsilateral midline shift.
3. Bilateral fracture dislocations
   a. Anterior open-bite due to shortening of both mandibular ramus.
4. Bilateral dislocation of condylar heads
   a. Pseudoprognathism.
   b. Inability to occlude teeth.
   c. Elongated face.
   d. Condyles palpable anterior to articular emience with preauricular hollow.

Management

Conservative

1. Minimal displacement—No active treatment. A normal occlusion is maintained which allows bonny union occur. In fracture-dislocation, a functional pseudarthrosis maybe produced.
2. Persistent—malocclusion or severe pain – A short period of intermaxillary fixation (7-10 days) until edema and muscle spasm disappear.
3. Bilateral fractures—A longer period of intermaxillary fixation (3-4 weeks) with posterior distraction blocks e.g., Stent compound, acrylic wedges. Elastic traction may be necessary to close anterior open-bite very much effective measures.

Surgical Indications

1. Compound and comminuted fractures.
2. Condylar displacement including fracture—dislocations with gross occlusal disruption.
3. Multiple facial fractures where mandible is used to stabilize mid-face.

Surgical Approaches

1. Preauricular Rowes modified.
2. Submandibular Risdon's incision.
3. Intraoral difficult approach.

Reduction: Difficult to reposition because of the muscular attachment.

Fixation: Wires, plates, pain and sutures (Fig. 25.4).

Conservative vs surgical approach: On the perspective of famous study of Walker of United States in the year 1960.

The observations are as follows:

1. Clinical data shows that bony union occurs condylar fractures regardless of whether intermaxillary fixation is used or not.

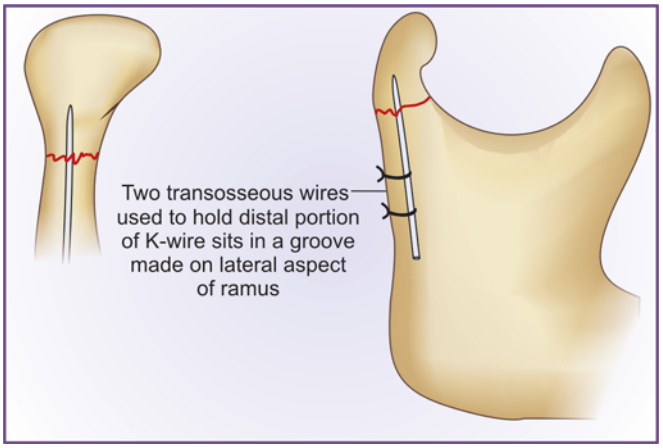

Fig. 25.4: Two transosseous wire used to hold the distal portion of K-wire which sits in groove made on lateral aspect ramus of the mandible to fix a fracture condyle (Brown and Obeid Technique, 1984)

2. Studies on Rhesus monkey found no difference between surgical and non-surgical treatment of condylar fractures.

Complication of condylar injuries: Only the T.M. Joint contusion that means injuries to soft tissue around the joint or an effusion within the joint.

Management includes soft diet, analgesic and anti inflammatory for relief of pain and exercise. Bite – raising appliances may be used to distract the joints. Short-wave diathermy may help. Other injuries associated with condylar regions mainly TM dysfunction syndrome, problems related to mandibular growth, dislocation and ankylosis discussed in detailed in Vol. I.

A simple guideline recommended by Peter Bank for immobilization of tooth bearing area of mandible.

Young adult
with
Fracture of the angle
receiving
Early treatment
in which
Tooth removed from fracture line
} 3 weeks

If:

a. Tooth retained in fracture line: add 1 week.
b. Fracture at the symphysis: add 1 week.
c. Age 40 years and over: add 1 or 2 weeks.
d. Children and adolescents: subtract 1 week.

Applying this guide, it follows that a fracture of the symphysis in a 40-year-old patient where the booth in the fracture line is retained requires 6 weeks' immobilization (basic 3 weeks + 1 week for less favorable site + 1 week allowed for age + 1 week for tooth retained in the line of fracture).

Teeth in the fracture line: Peter Bank summarized a consideration of the tooth or teeth present in the fracture line which is as follows:

Absolute indications for removal of a tooth from the fracture line:

1. Longitudinal fracture involving the root.
2. Dislocation or subluxation of the tooth from its socket.
3. Presence of periapical infection.
4. Infected fracture line.
5. Acute pericoronitis.

Relative indications for removal of a tooth from the fracture line:

1. Functionless tooth, which would eventually be removed electively.
2. Advanced caries.
3. Advanced periodontal disease.
4. Doubtful teeth, which could be added to existing dentures.
5. Teeth involved in untreated fractures presenting more than 3 days after injury.

It is desirable that all teeth not covered by these conditions should be retained.

Management of teeth retained in fracture line:

1. Good quality intraoral periapical radiograph.
2. Institution of appropriate systemic antibiotic therapy.
3. Splinting of tooth if mobile.
4. Endodontic therapy if pulp is exposed.
5. Immediate extraction if fracture becomes infected.
6. Follow-up for 1 year with endodontic therapy if there is demonstrable loss of vitality.

Clinical Features of Fracture Angle of the Mandible

a. Pain.
b. Tender on palpation.
c. Discontinuity of the fracture side.
d. Dearranged occlusion.
e. Deviation of the mandible.
f. Restricted movements of the mandible and partial trismus.
g. Crepitus.

Clinical Features of Body of the Mandible

a. Pain or moving jaw.
b. Trismus.
c. Movement and crepitus at the site of fracture.
d. Step deformity of lower border of the mandible.
e. Dearrangment of the occlusion.
f. Mental anesthesia.
g. Lingual hematoma and ecchymosis of buccal mucosa.

Clinical features of the fractures of parasymphysis (midline and canine regions): A midline fracture is very rare and displacement is much less. This fracture present obliquely to the one side of the genial tuber-

cle. Because of uneven pull of the muscle attached to the genial tubercle the fragment overwriting or overlapping to other fragments. This may be associated with the condylar fracture opposite side. Bilateral fracture of the middle fragment is pushed down words and inwards due to pull of suprahyoid group of muscles.

Concept of the Reduction of the Fracture Fragment

1. Reduction of the fracture is correct anatomical position based on to restore premorbid occlusion

The various methods of close reduction and indirect skeletal fixation

1. Direct interdental wiring (Gilmer, 1887).
2. Interdental eyelet wiring (IVY, 1922). This is most popular routinely used till today. It is a simple and effective method of the reduction and immobilization of the jaws, provided that each fragments contain a suitable number of teeth of suitable shape and quality (Rowe and William's, 1985).
3. Interdental eye late wiring of William modification, 1968 which is a second loop for the buccal wire in addition to the eye late for mechanical advantage for insertion of tie wire.

   Other various wiring less commonly used which includes Risdon Wiring, Kazanjian button, multiple loop wiring.
4. Arch bar
   a. Sauer's arch bar.
   b. Hauptmeyer's arch bar.
   c. Profile arch bar of Schlampp.
   d. Acrylated arch bar.
   e. Prefabricated arch bar – Jelenko, Winter, Erich (Row and William, 1985).
5. Metal cap splints.
6. Gunning splints.

Open reduction and direct skeletal fixation, which includes transosseous wiring, is the surgical union of two or more bone fragments with aid of wire ligatures passing via the drill hole made in the bone (Schwenzer, 1986). He also stated that this technique is in use since the beginning of nineteenth century, was not adopted and not popularized because of its associated complication. Schwenzer also mention the various ligature includes simple ligature, figure of eight ligature, combination of both double ligature, cross-ligature, transcircumferentin ligature etc.

Direct fixation or osteosynthesis: This can be describe as the retaintion elements which grip the bone immediately at the fracture ends. Osteo mean bone synthesis means joining or putting together (Figs 25.5A and B).

Osteosynthesis or rigid internal fixation comprises of:

A. Adaptational—miniplates, monocortical screws and plates (Maxim Champy). Monocortical plate is plating system in which the screw engages only one cortical plate (the outer cortical plate).
B. Compression
   I. Bicortical screws and plates (AO/ASIF). Plating system in which the screws are long enough to be fixed to the external as well as the internal cortical bony plates.
   II. Lag screws osteosynthesis is essentially a form of compression osteosynthesis in which the bone fragments are bound to one another under as a result of traction from the screw.

Figs 25.5A and B: The ideal line of osteosynthesis from Maxim Champy et al 1978

C. Mesh system.
Champy et al devised an experimental model of the mandible which mapped out ideal lines of osteosynthesis. By placing plate at most biomechanically favorable site (along tension bands), plate thickness could be kept to a minimum and yet strong enough to overcome displacing forces. Screws need only engage outer cortex.

Adaptational Technique of Fixation of Plate
(Figs 25.6 and 25.7)

1. Intraoral or transbuccal approach.
2. Adaptation of plate to bone surface contour.
3. Monocortical fixation of screw at least two on each side of the fracture line.
4. More posterior fracture requires plating at a higher level. More anterior fracture requires plating close to the lower border of the mandible.

Compression Plating System

AO—Association of Osteosynthesis.
ASIF—Association for the Study of Internal Fixation.
First introduced by Spiessl et al in Basel, Switzerland during the early 1970s.

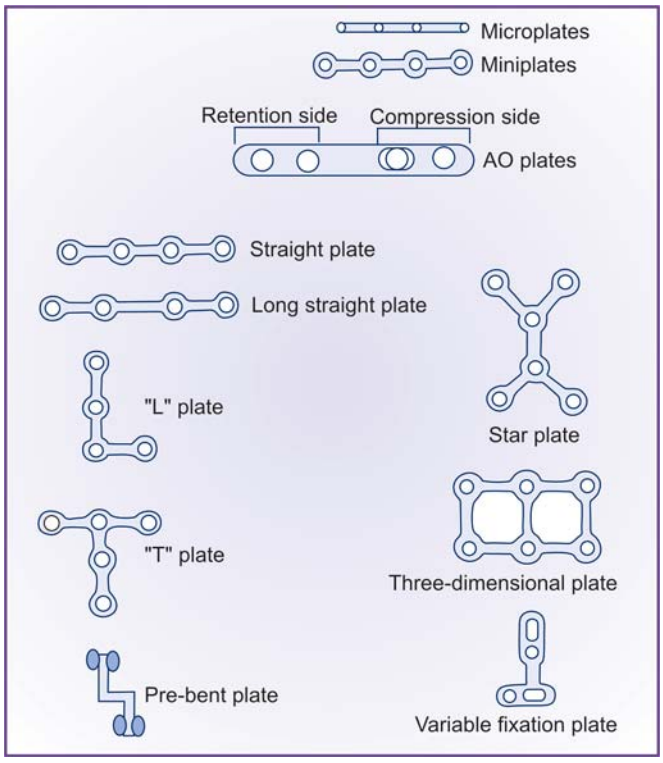

Fig. 25.6: Different plate sizes and different shape of plates

AO/ASIF Plating System

a. Mandible—used for bridging after resections and for compression of fractures
b. Midface—adaptational miniplates and screw.

Compression Principles

1. Compression plate (2 mm thick) seldom used
   a. Retention side (two holes or more).
   b. Compression side – two or more holes, and oblong sliding hole and an oval compression hole.
2. Bicortical pre-tapped screws (2.7 mm diameter).
3. Technique:
   a. Tighten retention screws on one side of fracture.
   b. Tighten compression screw on other side of fracture.
   c. Tighten screw in sliding hole on same side of fracture as compression screw.
3. Limitation—compression can cause significant occlusal and lingual cortex separation and thus have a limited use in dentate jaws.

Lag screw technique: Compression is achieved with a normal screw, which has threads along its entire length. The hole in the near cortex is enlarged so that threads do not engage.

Techniques

1. Fracture reduced and held position.
2. Hole is drilled through both cortices and hole through near cortex is enlarged.
3. Screw is passed into hole and lingual cortex of mandible is engaged and pulled towards buccal cortex for compression.

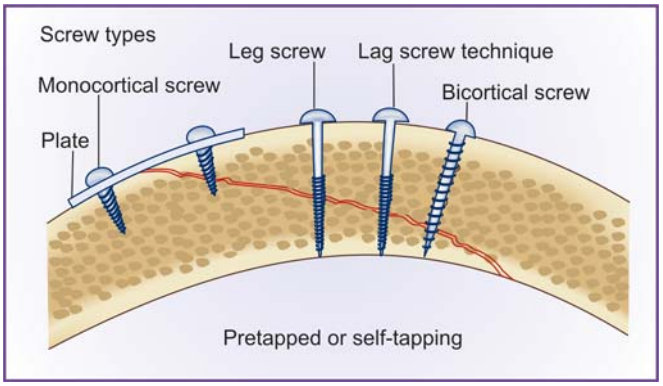

Fig. 25.7: Screw and plate technique for fixing of bone fracture of face

4. Ideally, three lag screws should be placed to prevent rotation.

Material Used for Osteosynthesis

1. Stainless steel.
2. Cobalt-chrome (Vitallium).
3. Titanium.
4. Bioabsorable (PLLA – poly-L-lactic acid).

Advantages of Bone Plating

1. Accurate reduction of the fracture is more easily achieved and one can be assured of bone to bone continuity.
2. Overwriting and vertical displacement of fragment are eliminated.
3. Difficult fracture are rapidly, simply and most effectively controlled.
4. With provide complete stability of obviating the need for any maxillomandibular fixation allowing early return of jaw function.

Fracture of Zygomatic Complex

The zygomatic bone closely associated with maxilla, frontal and temporal bones. They are usually involve when a zygomatic bone fracture occurred therefore, this type of fracture may be referred as zygomatico complex fracture. The zygomatic bone usually fractures in the sutural line as ZFS, ZTS and ZMS. It usually uncommon the zygomatic bone alone to be fracture. But in case of extensive trauma the bone may be communicated or split. The isolated zygomatic arch fracture may occur without displacement of zygomatic bone (Fig. 25.8).

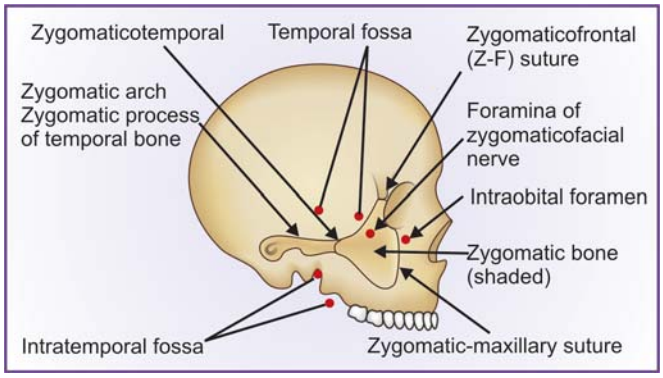

Fig. 25.8: Diagram showing the relation of zygomatic bone with the other parts of the facial skeleton

The Function of Zygoma

1. Protection of globe of eye.
2. To give origin to masseter muscle – zygomatic arch.
3. To transmit part of masticatory forces to cranial base.

Knight and Northwood Classification (1961) of zygomatic fracture on the basis of occipitomental view:

1. No significant displacement.
2. Fracture zygomatic arch only.
3. Unrotational body fracture.
4. Medially-rotational body fracture.
5. Laterally-rotational body fracture.
6. Complete rotational body fracture.

Classification of the Zygomatic Complex Fracture (Rowe and Killey 1968):

Type I: No significant displacement.
Type II: Fractures of the zygomatic arch.
Type III: Rotation around the vertical axis.
  a. Inward displacement of orbital rim.
  b. Outward displacement of orbital rim.
Type IV: Rotation around the longitudinal axis.
  a. Medical displacement of the frontal process.
  b. Lateral displacement of frontal process.
Type V: Displacement of the complex bloc.
  a. Medial.
  b. Inferior.
  c. Lateral (rare).
Type VI: Displacement of the orbitoantral partition.
  a. Inferiorly.
  b. Superiorly (rare).
Type VII: Displacement of orbital rim segments.
Type VIII: Complex comminuted fractures.

The above classification Rowe's change in 1985 and present classification on the basis of clinical significant by dividing the fracture into stable and unstable varieties. This classification also similar to advocated by Larsen and Thomsen in 1968 which is very simple lucid and applied oriented for zygomatic fractures.

- Group A: Stable fracture—showing minimal or no displacement and requires no intervention.
- Group B: Unstable fracture—with great displacement and disruption at the frontozygomatic suture and comminuted fractures. Requires reduction as well as fixation.
- Group C: Stable fracture—other types of zygomatic fractures, which require reduction, but no fixation. Fracture of the zygomatic arch alone not involving the orbit can be classified as follows:

1. Minimum or no displacement.
2. "V" type in fracture.
3. Comminuted fracture.

Henderson in 1973 recommended classification of zygomatic fractures into seven types:

Type I: Undisplaced fracture.
Type II: Arch fracture only.
Type III: Tripod malar fracture (F–Z suture intact).
Type IV: Tripod malar fracture (F–Z suture distracted).
Type V: Pure blowout fracture.
Type VI: Orbital rim fracture.
Type VII: Comminuted and other fractures.

Clinical Features of Zygomatic Fractures

1. Initial stage, circumorbital ecchymosis.
2. Edema and bruising over check.
3. Trismus.
4. Step deformity of the infraorbital margin.
5. Double vision.
6. Sometime exophthalmos.
7. Periorbital ecchymosis and subconjunctival hemorrhage.
8. Anesthesia or paraesthesia of infraorbital and anterior superior alveolar nerve.
9. Paraesthesia or anesthesia of zygomaticofacial and zygomatic temporal nerve.
10. Bleeding from the nose on the fracture side.

Late complication due to untreated or poorly treated:

1. Flat check.
2. Endophthalmos.
3. Altered papillary level.
4. Infraorbital paresthesia.
5. Double vision.

X-ray investigation: Occipipomental 15 and 30 degree.

Sub-mento Vertex Method (Jug Handle View)

True lateral view, occlusal view of maxilla, PA view of face, I/O Carmody Batson technique.

Surgical Approaches for the Management of Treating Zygoma Fracture

1. Temporal fossa.
2. Intraoral approach.
3. Percutaneous approach—Stab incision for introduction of Poswillo hook to pull the zygoma uppers, eyebrow incision by coronal flap.

Temporal fossa approaches (Gillies et al, 1927) under oral endotrachal zygomatic complex is reduced by an elevator (Bristow's elevator). The Gillies approach via temporal incision 45 degree oblique, made in hairline parallel to the anterior branch of superficial temporal artery above bifurcation. Temporal fascia exposed and incised. Howarth eletator passed below zygoma between temporalis facia and temporalis muscle; this acts as a guide for introduction of an elevator, e.g. Rowe's zygomatic elevator.

Firm upward and outward elevation is applied.

Postoperatively pressure on fractured malar should be avoided allowing healing with 3 weeks. For direct access to malar a preauricular incision (Al-Kayat and Bramley, 1979) is based.

Intraoral approach via a buccal vestibular immediately behind the zygomatic buttress, curved pointed elevator (Taylor–monk's pattern) passed upwards to contact intra temporal surface of zygoma allowing elevation of malar.

Percutaneous Approach

Stab incision placed at intersection of vertical line dropped from outer canthus of eye and horizontal line extending from alar margin of nostril.

Posswillo hook is inserted through incision below and behind the malar prominence. Reduction is achieved by strong outward traction of the handle avoiding infraorbital fissure which may result in haemorrhage from vein traversing it.

Eyebrow incision allows elevation of malar together with placing of a plate across zygomatic-frontal suture.

Bicoronal flap—can be used when flap is raised for other reasons, e.g. exploration of anterior cranial fossa.

Method of Stabilizing Zygomatic Fractures

1. Osteosynthesis
   a. Direct wiring.
   b. Champy mini-plates or micro-plates.
2. Antral support of which
   a. Packs
      i. White head varnish (Rowe and Killey, 1968).
      ii. Plastic tubing (Altosan et al, 1976).
   b. Balloon catheter (Shear and Anthony, 1952) – usually Follys catheter 30 cc used.
   c. Silicon-wedge Elastomer (Gorman).
3. External pin fixation, F-Z.

4. Internal pin fixation
   a. Transmaxillary K-wire.
   b. Nasomaxillary K-wire.

MID-FACE INJURY INCLUDING THE MIDDLE-THIRD FRACTURES OF THE FACIAL SKELETON

The surgical anatomy and the bones affected in this type of fractures discussed earlier in the introduction of maxillofacial injuries.

Middle-third of the facial skeleton classified clinically on the basis of French surgeon Rene Le Fort (1901) on the basis of experimental trauma applying to cadaverous head. This classification again modified by the reported study of Pape K of Germany (1969) of extended Le Fort fracture drew attention to the problem associated with anterior cranium. That means the involvement of middle third of facial skeleton with the frontal bone and this is called an extended Le Fort fracture (Figs. 25.9 and 25.10). The modified classification is as below:

Le Fort I	:	Guerin or low level fractures (Some degree of Ecchymosis in region of greater palatine foramen is called Guerin sign)
Le Fort II	:	Pyramidal or subzygomatic fractures
Le Fort III	:	High level or suprazygomatic fractures

Extended Le Fort involvement of Le Fort III plus upper-third of the facial skeleton.

Probably the most precisely documented classification proposed by Marciani in 1993, which includes Le Fort, NOE (Naso-orbitalethmoidal) and zygomaticomaxillary fracture patterns.

Le Fort I	:	Low maxillary fracture
Ia	:	Low maxillary fracture/multiple segments
Le Fort II	:	Pyramidal fracture
IIa	:	Pyramidal and nasal fracture
IIb	:	Pyramidal and NOE fracture
Le Fort III	:	Craniofacial dysjunction and nasal fracture
IIIa	:	Craniofacial dysjunction and nasal fracture
IIIb	:	Craniofacial dysjunction and NOE fracture
Le Fort IV	:	Le Fort II or III fracture and cranial base fracture

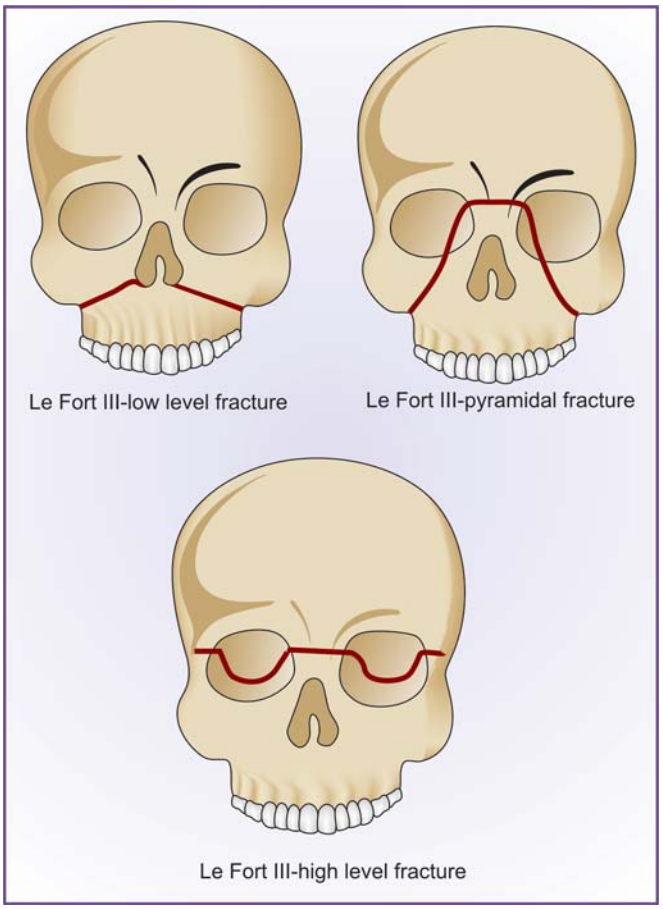

Fig. 25.9: Le Fort fractures

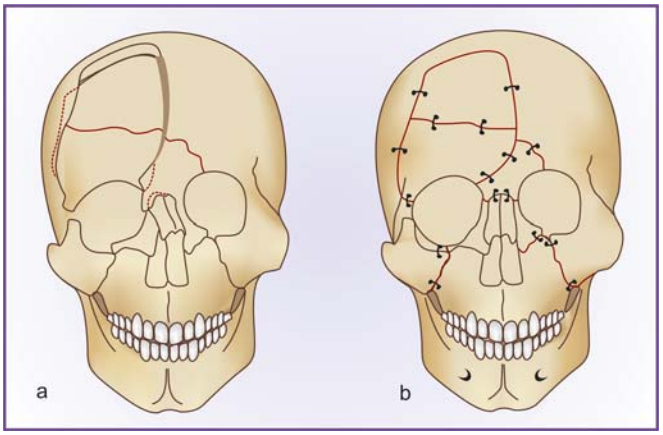

Fig. 25.10: Diagrammatic representation of an extended Le Fort fracture which involves the frontal bone, frontal sinuses and orbital roof (a) direct transosseous wiring of each individual fracture site. Recently mini cortical plate (Champy Plate) used for treatment. This is a case treated by French Surgeon, L. Merville represented in the above diagram (cited from Peter Bank) (b)

IVa : +Supraorbital rim fracture
IVb : +Anterior cranial fossa and supra-orbital rim fracture
IVc : +Anterior cranial fossa and orbital wall fracture

Another classification recommended for middle-third of the facial injuries by Rowe and Williams in the year 1985. This classification is simple, lucid and easy to remember covering the mid-face injuries in detail:

Fracture involving the occlusion:
1. Central region—key fractures involving:
   a. Nose and/or nasal septum.
   b. Fractures of frontal process of maxilla.
   c. Nasoethmoid.
   d. Fronto-orbitonasal.
2. Lateral region – zygomatic complex.

Fracture involving the occlusion:
1. Dentoalveolar fractures.
2. Subzygomatic:
   Le Fort I.
   Le Fort II.
3. Suprazygomatic
   Le Fort III.

Clinical Features of Le Fort I (Guerin or Sub-zygomatic Fracture):

Fracture line runs horizontally above the all-maxillary teeth at level of floor of nose. Fracture represent by:
a. Floating of palate.
b. Hematoma within the maxillary antrum.
c. Bilateral hematoma of cheek.
d. Dearranged occlusion with anterior open bite.
e. Some degree of ecchymosis in the region of greater palatine foramen (Guerin's sign).

Le Fort II Fractures (Low Pyramidal Subzygomatic Fracture): The Le Fort II fracture line crosses piramedially from nasal bone then frontal process of maxilla then lacrimal bone and infraorbital margin crosses the zygomatic buttress then move backwards and fracture above maxillary tuberosity.
a. Facial swelling with massive edema.
b. Subconjunctival ecchymosis and diplopia (Double vision), confirm by the Forced duction test and Hess test.
c. Dish-faced deformity.
d. Infra orbital anesthesia both side.
e. Bilateral hematoma palpable intraorally over malar buttresses.
f. Retroposed upper dental arch with anterior open bite.
g. Cracked pot sound on percussion of teeth.

Le Fort III Fractures (High Level Suprazygomatic Fracture): Craniofacial disjunction or suprazygomatic fracture. The fracture line runs from nasofrontal region then lacrimal bone then ethmoid bone around the optical canal involving infraorbital fissure then greater wing of the sphenoid then zygomaticofrontal suture, along with this, fracture the zygomatic arches of both sides.

Clinical features include:
a. Tenderness and separation at fronto zygomatic suture.
b. Tenderness and deformity of zygomatic arches.
c. Lengthening of face.
d. Depression of ocular levels.
e. Enopthalmos.
f. Hooding of eyes (It is due to the whole of the middle third of the face droop downwards with the downwards movement of eye ball leads to hooding of upper eye lid).
g. CSF leak from nose with associated signs of head injury.
h. Mobility of whole of facial skeleton as a single block.

X-ray investigation includes—occipitofrontal 25° and fronto-occipital 25°. This projection shows the petrous bone below the orbital margin hence the clarity of the orbital borders can be seen.

Former projection is preferred but the latter projection is used is used in those patients who cannot sit properly.

Occipitomental projection 30°: In this projection, the anterior aspect of all the facial bones seen clearly and comparative study of both sides can be made.

OPG and CT Scan and MRI also recommended for investigation.

Planning of Surgical Treatment

A. Emergency treatment—resuscitate patient
   - Stabilize mobile fragments to maintain airway (tracheostomy may be needed).
   - Arrest bleeding and transfusion if necessary.
   - Monitor vital signs.

B. Within twenty-four hours
- Repair of lacetrated wounds.
- Impression of teeth if necessary.
- Treatment the less severe maxillary fracture if no other major injuries.

C. Definitive treatment within 2 to 8 days optimum time to allow for improvement the medical condition of the patient clinical assessment and planning and reduction of soft tissue edema.

The various surgical procedures with multiple facial injuries:

- If require tracheostomy.
- Dentoalveolar injuries: Extract teeth beyond repair.
- Reduction and fixation of dento alveolar fragments by periodontal or arch bar wiring.
- Reduction of mandibular fracture – act as guide for correct positioning of maxilla.
- Zygomatic fractures – should be elevated to allow greater disimpaction of maxillae.
- Disimpaction and reduction of maxillae: a) open; b) Closed.
- Skeletal fixation:
  a. Internal
     i. Nonrigid:
        — Suspension wiring
        — Intramedullary pins
        — Transosseous wiring (Fig. 25.11)
     ii. Rigid:
        — Adaptational plates
        — Monocortical screws (Fig. 25.12)
  b. External:
     i. External pin fixation via frame or halo (Fig. 25.13)

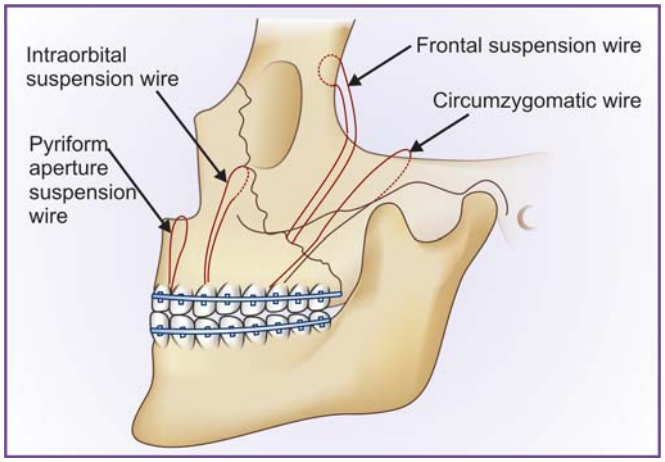

Fig. 25.11: Wire suspension of mid-face fracture

- Reduction and fixation of nasal fractures.
- Facial lacerations—give access to fracture sites:
  a. Clean and repair.
  b. Care of facial nerve, lacrimal apparatus, or parotid duct if indicated.

Treatment modalities of maxillary fractures, immobilization by internal skeletal fixation, which includes rigid internal fixation, wire suspension (recommended by Adams, 1942) used to reduce and suspend a mobile fragment below to a firm's stable fragment above the fracture by means of a 0.5 mm S S Wire. Frontal suspension approach is made the incision lateral-third of eyebrow to expose ZFS. Burr

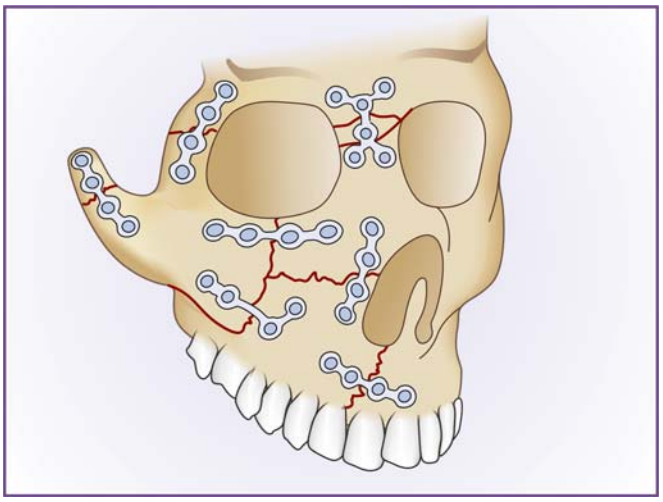

Fig. 25.12: Placement of mono-cortical screws and plate for the treatment of the mid-face fractures

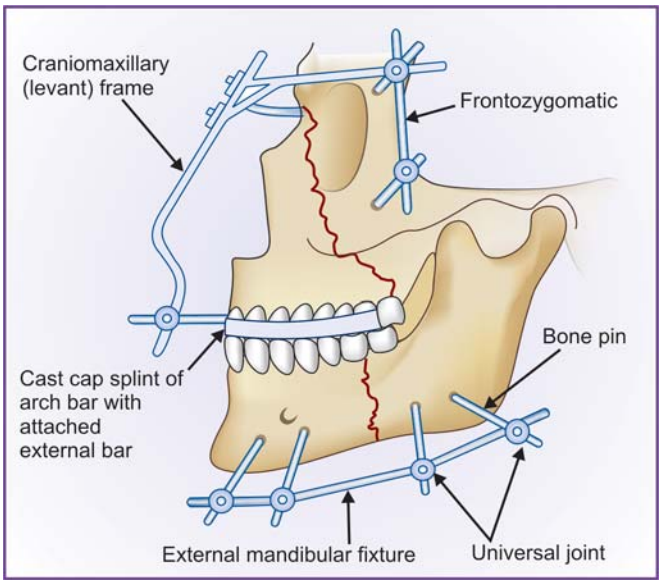

Fig. 25.13: External pin fixation for maxillary fracture

hole is made above ZFS and emerges in infra temporal fossa. Rowe's zygomatic awl both ends of the wire passed into mouth through upper buccal sulcus. Circum zygomatic suspension wire passed and attached to arch bar on maxillary teeth. Base of zygomatic buttress expose via buccal sulcus and wire inserted through a drill whole. The infra orbital suspension via upper labial sulcus incisational approach. Pyriform aperture suspension, bony pyriform aperture from nose exposed via the same incision made above and wire passed through. Circum palatal wire a longitudinal wire passed around palate provides good retention for gunning splint to maxilla.

Transfixation by K-Wire and trans osseous wiring.

Rigid internal fixation includes direct wiring at the sites of a fracture recommended by Merville in case of extended La Fort fracture.

The RIF now a day mostly used the mini-plates recommended by French Surgeon Champy.

Approach incision describes to reach the fracture areas discuss before (Chapter Surgical Dictum).

External Skeletal Fixation

a. Halo frame (Partially or completely encircles head, Royal Berkshire hospital pattern) causes difficulty to sleep with.
b. Levant Frame (develop at Royal Melbourne Hospital in the year 1960) Craniomaxillary fixation between supraorbital ridges and maxilla.
c. Box Frame (circummandibular fixation) middle-third of face is sandwiched between mandible and cranium. In case of emergency the releases of jaws is difficult.

Complication of major maxillary fractures: Immediate complication includes preoperatively difficulty in breathing due to posterior displacement of the maxilla causes soft palate to rest on dorsal surface of tongue. Establish airway and removal obstruction.

Bleeding is due to injury to the maxillary arteries. Ligation of the maxillary artery by transantral ligation and replacement of blood by transfusion.

Inhalation of tooth fragments should be removed carefully.

Postoperative complication includes control of bleeding, infection, malocclusion, facial scarring, and non-vital teeth.

FRACTURE OF NASAL BONE AND NASOETHMOIDAL INJURIES

Surgical anatomy: The upper part of nasal framework consists of two nasal bones with the frontal processes of maxillae and the nasal part of the frontal bone. Lower part of external nose consists of cartilaginous framework comprising of septal cartilage, upper nasal cartilage and lower nasal cartilages.

Nasal Septum: Nasal septum is a perpendicular plate of ethmoid, vomer, septal cargilage.

The classification of injuries recommended by Strane and Robertson in the year 1979 is as follows:

1. Frontal injuries:
   a. Plane 1—lower end of nasal bone and anterior nasal spine.
   b. Plane 2—external none.
   c. Plane 3—nasoethmoidal injury.
2. Lateral injuries:
   a. Without septal fracture.
   b. With septal fracture.

Clinical feature includes:

- Nasal deformity.
- Nasal bone crepitus.
- Bruising and edema.
- In the nasal passage blood clot and bony fragments.
- Mucosal tears and damage to nasal septum may be present.

Outline of treatment: Preferably within the first 24 hours or any time up to 7 days.

Reduction and Immobilization

- Reduction includes closed manipulation. Use of Walshm's forceps—left and right forceps to manipulate nasal bone at frontal process of maxillae. Asches septal forceps—to iron out nasal septum and to elevate the nasal bridge.
- Sub-mucous resection—(SMR) this SMR technique should be reserved for the patient who exhibits airway obstruction due to distorted septum (Harrison, 1979).
- Inter nasal immobilization includes Ribbon Gauze BIPP or whitehead varnish. Silastic implant and stainless steel inter nasal splint.
- External fixation includes Plaster of Paris splint, gauze and soft metal sheet (Tin/Lead Alloi), Thermoplastic splint and Compression plates.

Nasoethmoidal Injuries

Surgical anatomy: An area which lies behind the inter orbital space and situated between the medial walls of the orbits. This fractures are always comminuted.

Classification

Isolated Nasoethmoidal Injury

1. **Bilateral**—central injury resulting from direct blow over nasal bridge. Base of nose is driven backwards into interorbital space and nasal tip becomes upturned. Deep crease at base of nose and skin at base of nose frequently lacerated. CFS rhinorrhea should always be suspected.
2. **Unilateral** – unilateral nasal deformity. Side of nose is depressed and there is underlying fracture of ethmoid bone.

Combined Nasoethmoid Injury Plus Midface Fractures

1. **Bilateral**—nasoethmoid complex fracture combined with Le Fort II and Le Fort III fractures. Causes traumatic telecanthus and elongation of midface.
2. **Unilateral**—nasoethmoid complex injury plus severe comminution of orbit and zygomatic complex. Unilateral displacement of medial centhal ligament resulting in displacement of eye downwards and laterally.

Clinical Features

1. Depression of frontal bone.
2. Nasal deformity.
3. Traumatic telecanthus (increased inter canthal distance more than 35 mm. Normal range 25 to 35 mm).
4. Double vision.
5. CSF rhinorrhea.
6. Bleeding from anterior or posterior branches ethmoidal artery.

Outline of Treatment

A. Closed reduction—the use of transnasal wires and compression plates. The result is not satisfactory.
B. Open reduction—realignment of bony fragments under direct vision by surgical approach of various methods via existing laceration 'H' shaped incision, 'W' shaped incision, bilateral 'Z' incision, bicoronal flap, midline vertical incision, degloving of nose with bicoronal flap. To achieve repair of nasal bridge reattached to the frontal bone. Try to preserve on the bony fragments either directly wiring at the sites or use of mini plates and also care should be taken medial canthal ligament.

Blowout Fractures

Fracture of the orbital floor without affecting the orbital rim. They can affect orbital floor or medial wall of the orbit (Fig. 25.14).

Etiology: Blunt injury to the eye in the direct punch to eye. The impact is transmitted to the surrounding fat and consequently to the orbital wall.

It may part or most extensive fracture Le Fort – II, III and zygoma, or may be extension of fracture of the orbital rim.

Clinical Features

1. Ecchymosis of the eye (black eye).
2. Decreased vertical rotary movement.
3. Enophthalmos.
4. Ptosis of the upper eyelid.
5. Vertical diplopia.
6. Infraorbital anesthesia or paresthesia.

Radiological Investigation

Occipitomental 15 and 30° the radiological signs of blowout fractures include cloudy maxillary sinus due to hematoma formation.

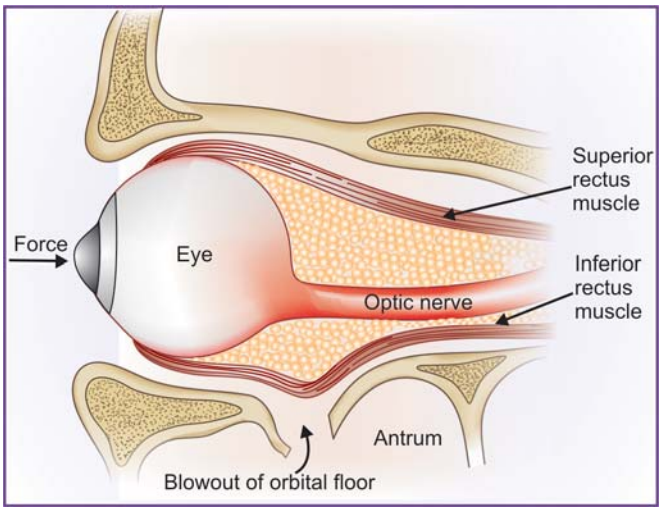

Fig. 25.14: Mechanism of blowout fracture

Hanging droop sign positive due to opacification caused by the herniation of soft periorbital tissue and bony fragments.

Fracture of zygoma and maxillae may present.

CT scan and orbital tomography may be recommended.

Forced duction test and retraction test are positive.

Outline of Treatment

Surgical intervention of various approach consist of trans conjunctival incision—this approach provide limited access to the orbital flow (Fig. 25.15).

Infraorbital incision includes Blepharoplasty, Second crease of lower eyelid incision. Naso-orbital incision.

The surgical procedure includes

1. Orbital floor graft, which may be autografts, allografts (processed bovine bone, lyophilized durametho d, zenoderm) alloplastic graft which includes dimethyl siloxane polymer.
2. Antral packing (Rowe and Killy, 1968) includes ribbon gauze soaked with whitehead varnish and plastic tubing (Altoman et al, 1976), Silicon Wedge Elastomer (Gorman, 1979)

Antral balloon, which may be (Shear and Anthony) balloon or 30 cc Foley's catheter (1976).

This treatment modalities discussed above should be done with the coordination of ophthalmic surgeon.

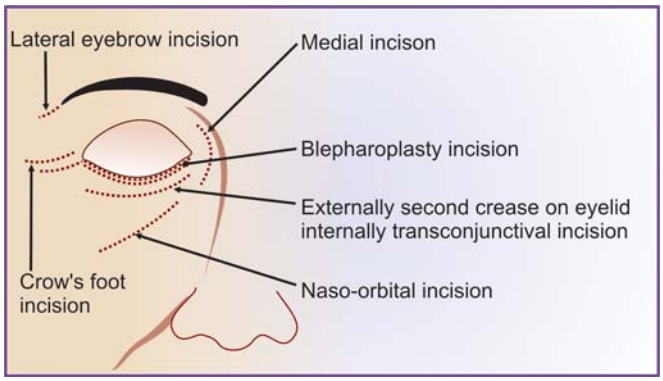

Fig. 25.15: Surgical approaches to the orbit by various incisions

Superior Orbital Fissure Syndrome

Injury and damage to the structures, which passes through the superior orbital fissure.

The following nerves, superior and inferior branches of III, IV, V (frontal, nasociliary and lacrimal) VI are present along with the ophthalmic veins.

The sign and symptoms include:

- Periorbital edema.
- Subconjunctival ecchymosis.
- Proptosis.
- Dilated pupil.
- Absent of light reflex.
- Presence of consensual reflex.
- Loss of accommodation of eye.
- Sensory loss of cornea and forehead.

Radiographic investigation: CT scan showing the reduction in size of superior orbital fissure.

Treatment includes—wait and watch consultation with opthalmologist. Care should be taken during treating fractured zygoma.

Orbital apex syndrome: It is a rare combination of superior orbital fissure syndrome with damage to the optic nerve leads to anterior ischemic optic neuropathy.

Clinical features—all the above mentioned for superior orbital fissure syndrome along with loss of vision.

Treatment—referred immediate for ophthalmic surgeon's consultation and treatment modalities.

FURTHER READING

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TWENTY-SIX

Diseases of Salivary Gland

• Mumps • Sialosis • Cat Scratch Disease • Sialadinitis • Sialolithiasis • Bacterial Sialadenitis • Xerostomia • Mikulicz's Disease • Fatty Infiltration • Salivary Gland Neoplasms • Pleomorphic Salivary Adenoma • Monomorphic Adenomas • Adenolymphoma • Monomorphic Adenomas • Malignant Salivary Gland Tumors • Acinic Cell Carcinoma • Adenoid Cystic Carcinoma

The salivary glands mainly three paired major glands, which includes the parotid, sub-mandibular and sub-lingual glands. About 500 hundred minor salivary glands which release their secretion into the oral cavity.

The development of the salivary glands consists of invagination of oral epithelium and the formation of the duct system. After that, the acini differentiate of these ducts. Because of the developmental as well as functional characteristic belongs to oral mucous membrane. Their secretion are either mucous or serous or mixed but the cells which line their ducts have the potentialities of differentiating into either a mucous or a serous type. The location, name and other features of the major and minor salivary glands given as follows:

Gland or glands	*Type of secretory cell*
Parotid	Serous
Submaxillary	Mainly serous but few mucus
Sublingual	Mainly mucous but few serous
Minor sublingual (Rivini's glands)	Mixed but mainly mucus
Glands of lip	Mixed but mainly mucus
Glands of cheek	Mixed but mainly mucus
Glossopalatine	Pure mucus
Anterior lingual (Blandin and Nuhn's gland)	Mixed
Glands of van Ebner (associated with circumvallate papillae)	Serous
Glands of root of tongue	Mucus
Glands of posterior half of hard palate	Mucus
Glands of soft palate and uvula	Mucus
Glands of retromolar pad	Mucus

The parotid gland releases its secretion into the oral cavity via the Stensen's duct, the submandibular gland via Wharton's duct, and the sublingual gland via the Bartholin's duct.

The minor sublingual glands (Rivini's glands) release their secretions by a number of small independent ducts into the oral cavity via the independent small orifices throughout the mucus surface.

The above table clearly shown the salivary glands presents throughout the oral cavity except the gingiva and the anterior half of the hard palate.

Infectious parotitis: Mumps—common virus infection affects children of parotid gland caused by paramyxo virus. Females and males children and young adult both are affected may be unilateral or bilateral defuse acute enlargement of parotid gland associated fever, malaise, loss of appetite and difficulty in opening the mouth. Usually self-limiting and resolves within a week although, rarely, complications such as pancreatitis, encephalitis, orchitis or oophoritis may develop.

Investigation and diagnosis: Usually based on characteristic history and clinical features. Diagnosis can be confirmed by serology (elevated IgM to 'S' and 'V' antigens).

Microscopically edema of the parotid gland with very sparse inflammatory exudates.

Treatment symptomatic and prognosis is excellent.

Sialosis: Uncommon non-inflammatory, non-neoplastic swelling of major salivary glands, most commonly affecting parotid glands although may also

affect submandibular glands. Generally, idiopathic although recognized associations include the following:

- Drug induced (e.g., isoprenaline, phenylbutazone and antithyroid agents)
- Diabetes mellitus
- Thyroid disease
- Pregnancy
- Malnutrition
- Anorexia and bulimia
- Cirrhosis and liver disease.

Histological features include serous acinar hypertrophy, edema of the interstitial stroma and striated duct atrophy.

Management: Identify and correct predisposing factors if possible.

Cat scratch disease is a viral disease initially affects the lymph nodes. Parotid and sub-mandibular glands are involved mostly and it has an incubation period of one to three weeks. The young adult affected more during the winter season. The regional nodes are enlarged and tender patient complain of fever, malaise, nausea, headache and chill. The disease is self-limiting, and regresses within six weeks.

Microscopically, show the hyperplastic lymph nodes with minute multiple abscesses. Central area of necrosis surrounded by a dense aggregate of neutrophils with a zone of histocytes.

Treatment includes symptomatic and lesions heal without complication.

Sialadinitis means inflammation of the salivary gland. Usually, associated with the formation of salivary stone (Sialolithiasis) and inflammation of the major duct (Silodochitis). Occasionally, it maybe due to acute infection from the oral cavity rarely from hematogenous route.

Acute sialadenitis is rare it is not associated with stone or calculus.

Clinical features include swelling redness and pain of the affected gland. Compression of the gland may produce discharges of the pus and the symptoms not precipitated during eating.

Sialolithiasis: Salivary calculi mean the stone or calculus within the salivary gland. History of recurrent pain and swelling before and during meals due to obstruction by the calculus or stone. X-rays shows the presence of radio-opaque stone. The classic sign and symptoms of sialolithiasis includes as pain and swelling during meal times. Decrease secretion of saliva with tenderness. Presence palpable stone in floor of the mouth. Sialography is a technique in which the salivary duct is cannulated with a plastic or metal catheter, a radiographic contrast medium is injected into the ductal system and the substance of the gland, and a series of radiographs are obtained during this process. Approximately 0.5 to 1 ml of contrast material can be injected into the duct and gland before the patient begins to experience pain. The two types of contrast media available for sialographic studies are water-soluble and oil-based. Both types of contrast material contain relatively high concentrations (25 to 40%) of iodine. Most clinicians prefer to use water-soluble media, which are more miscible with salivary secretions, more easily injected into the finer portions of the ductal system, and more readily eliminated from the gland after the study is completed, either by drainage through the duct or systemic absorption from the gland and excretion through the kidneys. Sialography reveals a stricture or obstruction commonest in the submandibular ducts (Figs 26.1 and 26.2).

Others diagnostics includes computed tomography, MRI, Ultrasound and sialoendoscopy, FNAC and salivary gland biopsy.

Bacterial sialadenitis: Usually, occurs in association with local (e.g. calculus, mucous plug or duct stricture) or systemic cause (e.g. diabetes mellitus or Sjögren's syndrome) of reduced salivary flow. Previously a relatively common postoperative complication due to dehydration although this is now rare. Ascending infection from oral flora. The main organisms involved are *Staphylococcus aureus*, streptococci and anaerobes.

Fig. 26.1: Sialography of parotid
(The characteristic sausaglink)

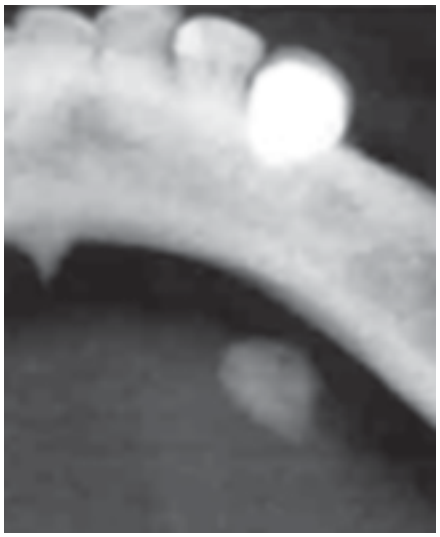

Fig. 26.2: Sialolithiasis: Stone within the submandibular gland

Clinical features: Pain and swelling of the affected gland. Associated pyrexia, malaise and occasional erythema of the overlying skin. Pus may be expressed from the involved gland duct orifice.

Investigation and diagnosis: Pus for culture and sensitivity.

Treatment: Antibiotics (Amoxycillin or flucloxacillin if due to staphylococci). Encourage drainage by use of sialogogues. After acute infection has resolved, sialography should be performed to exclude predisposing factors such as calculi or duct strictures.

The stricture of the salivary gland may due to obstructive disease with irregular narrowing of duct due to reparative fibrosis. This may also due to obstructive damaged to the duct and presence of calculus or stone.

Treatment: Transoral sialolithotomy.

1. Placement of stay suture posterior to the stone. It avoids the dislodgement of the stone posteriorly.
2. A gentle incision overlying the palpable stone and milk the gland to bring out the stone.
3. Careful about the lingual vessels of the floor of the mouth, see the no obstruction of the gland.
4. Suture may or may not be necessary.

Certain disorders of the salivary gland in brief:

Xerostomia: the condition called as dryness of the mouth due to less or least flow of secretion of the salivary gland. The probable causes of xerostomia as follows:

- Anxiety
- Drug induced (tricyclic antidepressants, phenothiazines, antihistamines)
- Aplasia of the major salivary glands (rare)
- Postirradiation
- Sjögren's syndrome
- Sarcoidosis
- Dehydration (e.g., diabetes mellitus, renal failure, fluid loss)
- HIV salivary gland disease.

Sjögren's syndrome (Sicca syndrome, sicca means dry): Sjögren's syndrome consists of enlargement of the salivary glands, dry mouth (xerostomia), dryness of the conjunctiva and pharyngeal, nasal and laryngeal mucosal (conjunctivitis sicca, rhinitis sicca, and pharyngolaryngitis sicca), and arthritis. The disease is seen most-frequently in middle-aged and elderly women. Because of the dryness of the mucous membranes, there is secondary inflammation of those areas. The involved exocrine glands show infiltration by lymphocytes and atrophy of acini.

It is a chronic inflammatory disease with probable autoimmune disease, represent by two varieties primary and the secondary.

Clinical features of primary Sjögren's syndrome include xerostomia (dry mouth), xerophthaimia (dry eyes).

Secondary xerostomia, xerophthalmia, connective tissue disorder—most commonly rheumatoid arthritis. Other possible connective tissue disorders include systemic lupus erythematosus, primary biliary cirrhosis, mixed connective tissue disorder.

Investigation and diagnosis: No single test will consistently and reliably establish the diagnosis; the following investigations may provide supportive evidence of a positive diagnosis of Sjrogren's syndrome;

- Salivary flow rate (stimulated parotid flow rate normally > 1.5 ml/minute)
- Schirmer test—assesses lacrimal flow (positive if < 5 mm wetting in 5 minutes)
- Immunological investigations—rheumatoid factor, anti-nuclear factor, anti-Ro (SS-A) and anti-La (SS-B)
- Sialography—variable degrees of sialectasis are found in patients with Sjrogren's although this abnormally is not specific
- Scintigraphy—both uptake and excretion of the radioactive isotope sodium pertechnetate is diminished

- Labial gland biopsy—histological features, which support the diagnosis, include focal lymphocytic sialadenitis, duct dilation, acinar loss and periductal fibrosis.

Treatment is largely non-specific and simply aimed at controlling symptoms. Maintain, adequate hydratin. Salivary substitutes (e.g. 'Saliva Orthana' and 'Glandosane'). Salivary stimulants: chewing gum, glycerine and lemon but avoid in dentate patients due to low pH; pilocarpine. Preventive dental care—fluoride rines. Denture hygiene measures because of increased risk of candidosis. Treat acute episodes of bacterial sialadenitis with appropriate antibiotics.

Sarcoidosis (Besnier Boeck Schaumann disease) granulomatous disorder of unknown etiology mostly affected young adult specially females. Affected usual location parotid gland manifested unilateral or bilateral enlargement of the affected gland associated with respiratory distress with fever.

Histologically, circumscribed foci of epithelioid cells and giant cells in gland, no necrosis.

Mikulicz's disease (Benign lymphoepithelial lesion) parotid is affected glands males are affected more than females usually in younger age.

Clinical feature circumscribed area of lymphoid tissue or diffuse infiltration of gland by lymphocytes; islands of squomoid and glandular epithelium.

Fatty infiltration: Parotid is affected glands, affected age third to fifth decade of life. Males and females are equally affected. Rare condition; unilateral or bilateral diffuse enlargement of parotid gland; long duration, old age, alcoholism, pregnancy, or malnutrition.

Microscopically, fatty infiltration of involved gland.

Salivary gland neoplasms: The salivary tumors are relatively uncommon comprise only three percent of all tumors of which eighty percent occur in the major glands and twenty percent occur in the minor glands. The parotid tumors are common than the submandibular, sublingual and minor glands. The classification of salivary gland tumors as follows:

Benign	*Malignant*
Pleomorphic salivary adenoma	Mucoepidermoid carcinoma, Acinic cell carcinoma
Monomorphic adenomas	Adenoid cystic carcinoma
Adenolymphoma	Polymorphous low grade adenocarcinoma
Oxyphilic, basal cell, tubular, clear cell, trabecular etc.	Carcinoma arsing in pleomorphic adenoma

Pleomorphic salivary adenoma: Most commonest salivary gland tumor. Ninety percent in the parotid remain in other gland tumors. Affected ages in fifth and six decade of life. Females are affected > males (Figs 26.3 and 26.4).

Clinical features: Slow growing, painless, rubbery mass.

Histological features include intermingled epithelial and mesenchymal tissue, as the name suggested. Connective tissue capsule is poorly-developed and some areas with outwards growth of the main tumor mass extending beyond the capsule.

Treatment includes if cosmetic problems excision of the glands. Prognosis is good.

Fig. 26.3: Pleomorphic adenoma

Fig. 26.4: Malignant transformation of pleomorphic adenoma

Monomorphic Adenomas: It is less common than the Plemorphic adenoma. It is the one of the variety of histological pattern.

Adenolymphoma: It is one of the varieties of Monomorphic adenoma most commonly seen. Affected age more than fifty years. Male female ratio 1.5:1.

Clinical features: Painless, firm on palpation clinically indistinguishable from other benign parotid tumors.

Histologically, it is well-capsulated, papillary cystic structures mainly epithelium and lymphoid tissue.

Monomorphic adenomas having several histological varieties which includes oxyphilic, basal cell, tubular, clear cell, trabecular etc. Other than histological varieties, clinical features are mostly same.

Malignant salivary gland tumors include mucoepidermoid carcinoma: It affects mainly the parotid the incidence mostly seen forth and fifth decades of life. Females are more affected than males. The presence of variable grade of malignancy, which influences the rate of growth. Low-grade tumors usually present as painless slowly enlarge growth not unlike a pleomorphic adenoma. Tumors are high-grade malignancy grow rapidly and local pain may be an early feature. Facial palsy, lymph nodes involvement and distant metastases common.

Acinic cell carcinoma: Uncommon tumor mainly in parotid. Clinical presentation is similar to that of a pleomorphic adenoma. Behavior unpredictable.

Microscopic appearance a single cell type with a very large cell and the round duct nucleus and deep basophilic granular cytoplasam. The cell resembles the acinar cells of the serous gland and arranged in broadsheet. The tumor is low-grade malignancy.

Treatment includes surgical excision.

Adenoid cystic carcinoma: Usually, affects middle-aged and elderly; accounts for 15 percent of minor gland tumors, 2 to 3 percent of parotid tumors. Slow growing tumor, which may initially be clinically-indistinguishable from a plemorphic adenoma. Local pain, ulceration of overlying mucosal, fixation to deeper structures and facial nerve palsy (in case of parotid tumor) may be features. Widely infiltrative with perineural spread. Cribriform or '*Swiss cheese*' pattern.

Microscopic picture: Shows the small, dark, stained epithelial which resembles the basal cells of mucous membrane. Because of this feature, it is sometimes called basaloid mixed tumor. The epithelial cells are arranged in tubes, islands, columns and acini. Microscopic field looks like '*Swiss cheese*' pattern.

Treatment: Wide excision.

Carcinoma arises in pleomorphic adenoma: Most arise in parotid tumors, which have been present for 10 to 15 years. Characteristic sudden increase in rate of growth.

Treatment: In case of pleomorphic adenoma involving maxillae, subtotal maxillectomy.

In the malignant transformation, wide excision of the tumor. Radiation is contraindicated as the tumor is radioresistant.

TWENTY-SEVEN

Preprosthetic Surgery

- **Alveolar Surgery for Ridge Correction**
- **Alveolar Surgery for Ridge Extension**
- **Alveolar Surgery for Ridge Augmentation**

'Pre' means prior, prior surgery for better prosthetic rehabilitation (prosthetic means replacement of artificial teeth in the form denture may be partial or complete).

The aim of preprosthetic surgery is to achieve better retention, stability, esthetic and functional ability of prosthesis.

Preprosthetic surgical modalities aid to prosthodontist by the oral surgeon for successful prosthetic rehabilitation.

The preprosthetic surgical modalities includes to achieve the criteria as follows:

i. Alveolar surgery for ridge correction.
ii. Alveolar surgery for ridge extension.
iii. Alveolar surgery for ridge augmentation.

ALVEOLAR SURGERY FOR RIDGE CORRECTION

The surgery mainly divided into the soft tissue related and the hard tissue related surgery.

The hard tissue related surgery includes:

1. Excision of Tori (rare)—the palatal exostosis or tori rarely seen as bony growth. This excessive bony tissue must be removed from the palatal aspect for better adaptation of complete denture prothesis. The mandibular tori may be present on the lingual aspect very rarely. The excision of the excessive growth is necessary for the same reason. The toras palatinus is excised via a 'Y' shaped midline sagittal incision and the bony prominence removed with burs or chisels. A hemorrhagic splint made of clear acrylic placed after suture to prevent formation of haematoma.
2. Reduction of mylohyoid ridge is necessary to avoid displacement of the denture by reducing the ridges.
3. Removal of exostosis in the region of maxillary tuberosity.
4. In the mandible, the mental foramen can open on the ridge and cause pain from pressure of the denture due to the resorption of alveolar bone. To relief the symptoms, the position of the mental nerve to be changed at lowers level. A crestal incision is made with the buccal extension. The nerve is gently separated with a hook and protected with blunt instrument. Another nerve path is created by means of a Fissure Bur at lower level. And the nerve is placed in new position to avoid pressure from the denture. Thereby, relief of pain is achieved.
5. Alveolectomy—the removal of alveolar process following extraction and consequently the removal of sharp margins of inter dental, inter shapetal or lavio buccal alveolar crest with the rongur and smoothened with the bone file.
6. Alveoloplasty—the trimming and reshaping of the knife-edge ridge. The recontouring of the alveolar ridge is done to reserve of soft tissue and bone for the maximum denture support.
7. Interseptal alveolectomy or alveoplasty with repositioning of the labial cortical bone recommended by Dean's. This surgical modality is limited to maxillae mainly to the anterior region. It is indicated to reduce maxillary overjet. It also reduces the volume of cancellous bone to maintain stress bearing cortical bone (Fig. 27.1).

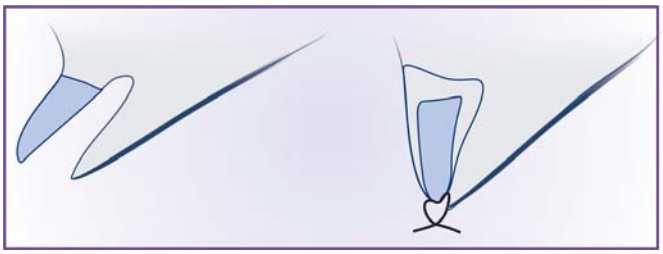

Fig. 27.1: Dean's technique (1941)

Technique includes:

a. Removal of interseptal bone following atraumatic extraction to the labial cortex.
b. Placement of labial cortical bone in the new position. After obtain local anesthesia and completion of the step (a) mentioned above. The interseptal bone is removed by surgical bur with flashing of the water. A vulcanite bur is used to make a tunnel from canine to the opposite of the canine. Toileting of the bony socket examine the tunnel the bony bed completely avascular. Then a vertical oblique incision is made both sides of the socket of the canine. A Fissure Bur or osteotome is using for bony cut of both sides of the labial cortical plate. Then a bony sheers is rotated gently towards the labiocortical plate fracturing the labial bony fragments attached with intact mucoperiosteum. After that the labial cortical plate pushed palatally and repositioning the labial cortical plate and approximation with the palatal cortex. Then the suture placed at the same. Antibiotics, analgesic and anti-inflammatory drugs are prescribed with maintenance of oral hygiene and saline mouth after 24 hours. This technique is known as Dean's technique.

Obwegeser's modified the Dean's interseptal alveoloplasty by repositioning of both labial and palatal cortex. The Dean's technique only the labial cortical plate is involved. The technique is same as above but palatal cortical plate is included by making horizontal cuts are made in the both labial and palatal cortex. This technique is indicated when the sufficient over jet is not reduced (Fig. 27.2).

8. Excision or reduction of the genial tubercles—The attachment of genioglossus muscle with the genial tubercle sometimes may cause interference of adaptation of denture due to gross resorption of the mandibular ridge.

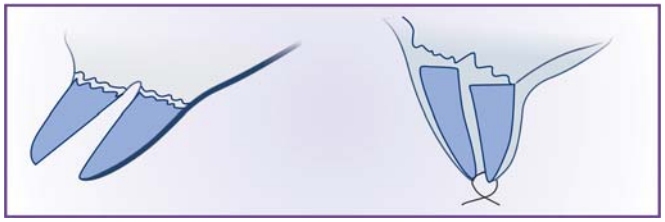

Fig. 27.2: Obwegeser's technique (1968)

Technique includes an alveolar crestal incision is made from lower canine to the opposite lower canine. A mucoperiosteal flap is raised on the lingual side without raising the labial mucoperiosteal flap. The muscle attachment is gently dissected and the excision of the genial tubercle by rotary instrumentation with copious irrigation of the area. Then the smoothening of the area with a bony file. Toileting of the wound, control of bleeding and placement of the suture.

The soft tissue related surgeries are the following:

1. Excision of redundant crestal soft tissue.
2. Excision of denture hyperplasia.
3. Excision of epulis fissuramatum.
4. Reduction of the fibrous tuberosity.
5. Fraenectomy.

The soft tissue related surgery mainly excessive hyperplastic tissue or over growth in response to the chronic trauma. This is may be due to over extended denture flange, which transmits the masticatory forces to the soft tissues. This situation often occurs following the resorption of the ridges. The denture hyperplasia may present at one fold or a series of folds, which lie in the buccal sulcus between the alveolus and the denture or along the periphery of the flange. The reduction of the soft fibrous tuberosities with deep sulci assists denture retention and stability.

Treatment includes:

1. Removal of irritation.
2. Excision of the soft tissue that means hyperplastic mass.
3. Cryosurgery gives satisfactory results.
4. Alternate excision by carbon dioxide laser to excise hyperplastic tissue.

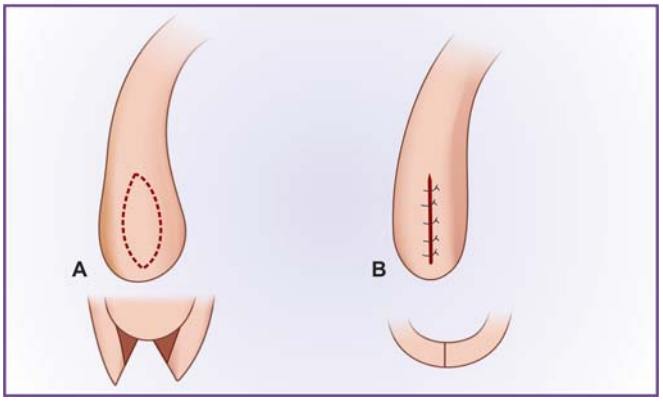

Fig. 27.3: (A) Reduction of fibrous tuberosity and elliptical incision over tuberosity then excising deep portion (shaded). (B) To allow flaps to apposed on bone without tension and suture placed for closure

Fraenectomy

Fraenum is a musculofibrous brand attached to the alveolus inserted into the muscle of the face. The most important is the labial fraena in the midline of the upper and lower jaw.

During the movement of the facial muscles, they lift the dentures and show break peripheral seal. The denture can usually be relieved round them but where the ridges have resorbed this may greatly reduce the possible depth of the flange and even weaken the denture, making surgery be excision necessary.

THE SURGICAL TECHNIQUE OF FRAENECTOMY

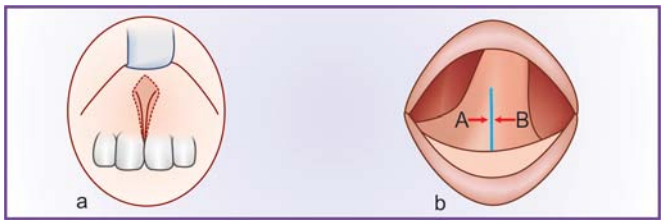

Fig. 27.4: (a) Incision for excision of labial fraenum. (b) Lingual fraenum lengthened by making a horizontal incision A-B and suturing it vertically

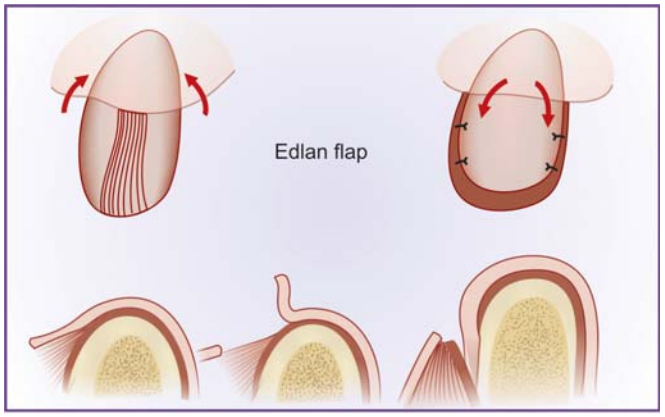

Fig. 27.5: Edlan's (1963) technique is designed to reduce the amount of scar contraction inherent in the above technique. The mucosal flap, based on the alveolar crest, is dissected off the underlying fraenum. The periosteum is incised around the fraenum and both are reflected off the underlying bone. The periphery of the mucosa is sutured to the junction of attached and detached periosteum so separating the fraenum from bone. It is advisable to excise as much of the muscular fraenal tissues as possible to lessen the risk of recurrence

ALVEOLAR SURGERY FOR RIDGE EXTENSION

Louis H Guernsey and Gustav Kruger excellently summarized the various ridge extension procedures as follows:

Maxillary Procedures

1. Secondary epithelialization vestibuloplasty
   a. Full thickness mucoperiosteum dissection—Collett.
   b. Submucosal dissection, periosteum intact—Szaba.
2. Submucosal vestibuloplasty—Obwegeser, Yrastorza.
3. Ridge skin grafting vestibuloplasty—Weiser, Schuchardt.
4. Buccal sulcus skin grafting—Esser, Gillies
5. Ridge mucosa grafting vestibuloplasty—Obwegeser, Steinhauser.

Mandibular Procedures

Buccal Approach

1. Submucosal dissection, periosteum intact
   a. Secondary epithelization vestibuloplasty
      1. Incision in lip mucosa—Kazanjian
      2. Incision over crest of ridge—Clark
   b. Ridge skin grafting vestibuloplasty—Obwegeser, McIntosh and Obwegeser
   c. Mucosa grafting vestibuloplasty—Propper, Nabers, Hall and O'Steen.
2. Full thickness mucoperiosteum dissection
   a. Incision in lip mucosa—Godwin
   b. Incision on crest of ridge with mental nerve lowering and lingual frenotomy with genioglossus transplant—Colley
   c. Ridge skin grafting and incision on crest of ridge, with genial tubercle removal and repositioning of genioglossus and geniohyoid muscles—Anderson (Fig. 27.6).

Lingual Approach

1. Submucosal dissection, periosteum intact
   a. Secondary epithelialization
      1. Lingual sulcus extension with resection of mylohyoid muscle and with or without lingual skin graft—Trauner (Fig. 27.7)
      2. Floor of mouth lowering—Trauner, Obwegeser
      3. Sublingual ridge extension with free mucosa graft—Lewis
2. Full thickness mucoperiosteum dissection
   a. Lingual sulcus extension with resection of mylohyoid ridge, mylohyoid muscle, and lingual flap cover of bone—Obwegeser

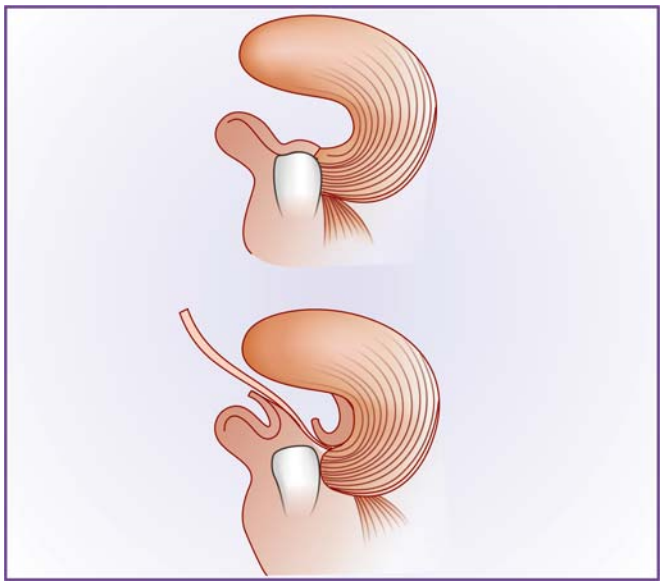

Fig. 27.6: Diagrammatic representation of stage I of Anderson's technique (1969) for the lowering of the genial muscles. The tendinous muscle insertion is transfixed with a strong absorbable suture which is clipped and lies outside of the mouth

b. Lingual ridge extension—Caldwell
c. Lingual sulcus extension with free skin graft—Ashley

Labiolingual Approach

1. Sub-mucosal approach, periosteum intact
   a. Anterior buccal and sublingual sulcus extension with fenestration procedure—Baurmash
   b. Ridge skin grafting vestibuloplasty combined with total lowering of floor of mouth—Obwegeser.

The above-mentioned various surgical modalities of which the following techniques are commonly used:

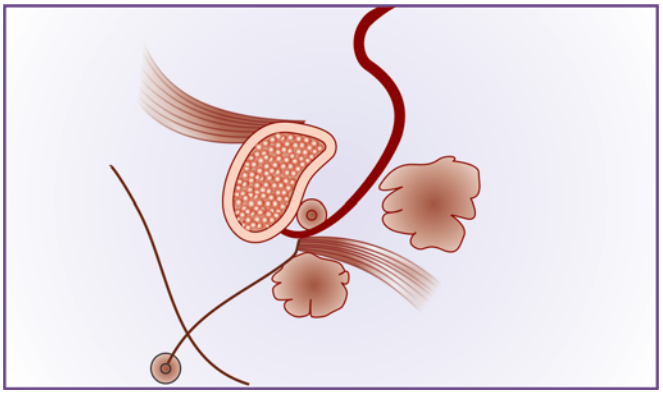

Fig. 27.7: Essentially this is a supraperiosteal reflection of the mucosa and mylohyoid muscle leaving the ridge undisturbed

Kazanjian labial vestibuloplasty in this technique the inner aspect of the lower lip mucosal flap is raised. To achieve to increase of depth of the anterior mandibular labial vestibule. Surgery is made from pre-molar to opposite pre-molar regions and the raw area is left on the lip site to heal by the secondary intension keeping the periosteum on the bone intact (Fig. 27.8).

Clark's method of labial vestibuloplasty, the flap is pedicle off and lip and bone is left exposed (Fig. 27.9).

Labial vestibulor procedure or lip switch procedure by Howe's other name is transpositional flap vestibuloplasty. In this technique, alveolar periosteal flap is raised and subsequently the lip submucosal flap is also raised and suture inversely. That means the periosteum is suture-exposed surface of lip and submucosal flap is sutured to the bony bed.

Obwegeser's modified the Clark's method. The variation is area of alveolar bone with its periosteum attachment is covered with a split, thickness, skin graft

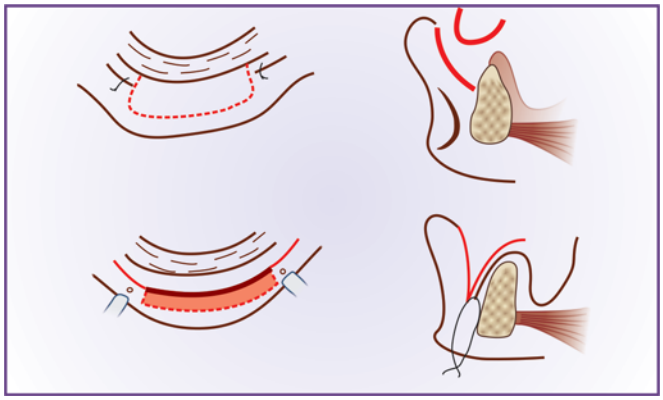

Fig. 27.8: Kazanjian vestibuloplasty

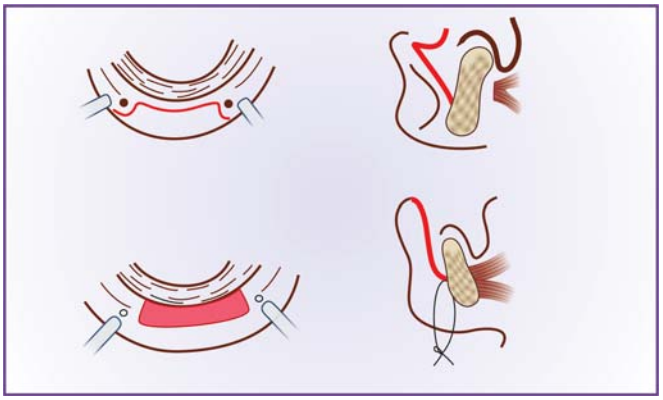

Fig. 27.9: Clark's labial vestibuloplasty

and held in position by suture or Stent constructed preoperatively (A Stent was introduced by an English dentist Charles R. Stent. It is eponym for a device used in conjunction with surgical procedure to keep a skin graft in place: often modified with acrylic resin or dental impression compound that was previously turn Stent's compound. Stent is used to apply pressure to soft tissues to facilitate healing and prevent cicatrisation or collapse).

ALVEOLAR SURGERY FOR RIDGE AUGMENTATION

In case of alveolar resorption, restoration of optimum or near optimum of ridge height and width and adequate ridge form with vestibulor depth is mandatory.

To surgical methods or options are available one is the augmentation of the alveolar ridge and two is placement of implants.

Ridge augmentation of various procedures summarized by Russel Hopkins in his famous pre-prosthetic oral surgery in the year 1987, which includes (Figs 27.10 to 27.12):

Mandibular Augmentations

1. Superior border augmentation
   a. Bone grafts
   b. Cartilage grafts
   c. Alloplastic grafts.
2. Inferior border augmentation
   a. Bone grafts (autogenous or allogenic freeze-dried cadaveric mandible)
   b. Cartilage grafts.
3. Interpositional or sandwich bone grafts
   a. Bone grafts
   b. Cartilage grafts
   c. Hydroxyapatite blocks.
4. Visor osteotomy
5. Onlay grafting—autogenous, alloplastic, allogenic material.

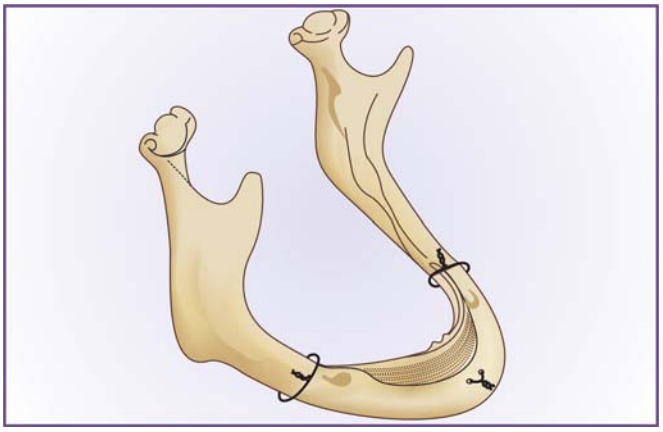

Fig. 27.11: In the visor osteotomy Harle (1975) osteotomized the mandible leaving each section pedicled by the muscles inserted into them, so maintaining a blood supply to the bone and periosteum. Prosthetic difficulty in this situation it is reasonable to offer ridge augmentation procedures, which will strengthen the jaw as well as increase its dimensions. The difficulty in writing about this subject is that new techniques appear with great frequency and new materials, e.g. hydroxylapatite, have accelerated these developments. What is written today maybe out of date by the time it is published. All of the following techniques seek to overcome the problem of the rapid resorption of the free onlay bone graft – cited from Russell Hopkins

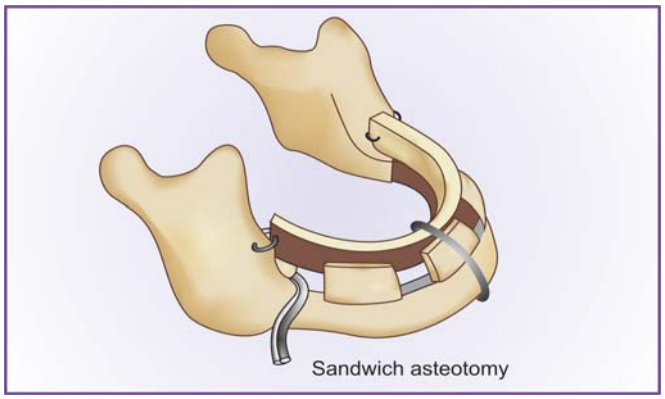

Fig. 27.10: Corticocancellous bone blocks can augment the visor osteotomy if the preoperative vertical height of the anterior mandible is less that 2 cm

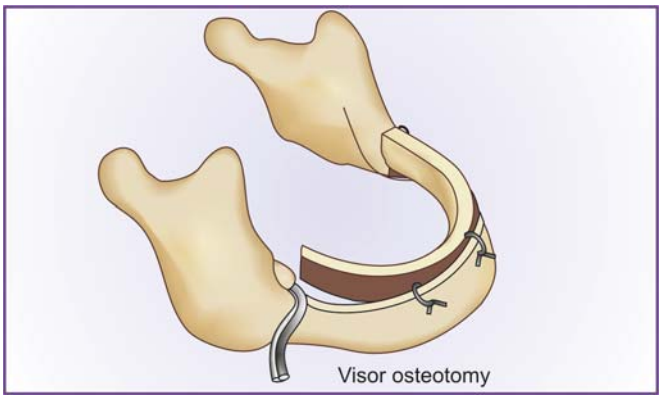

Fig. 27.12: The visor osteotomy can be augmented by corticocancellous bone blocks if the preoperative vertical height of the anterior mandible is less that 2 cm.

Maxillary Augmentation

1. Onlay bone grafting—autogenous/allogenic grafts
2. Onlay grafting of alloplastic material
3. Interpositional or Sandwich grafts
4. Sinus lift procedure.

Augmentation in Combination with Orthognathic Surgery

1. Mandibular osteotomy procedure
2. Maxillary osteotomy procedure
3. Combination procedure.

The material used for augmentation of alveolar ridge:

1. Autogenous or autogrft—the living autogenous tissue.
2. Allogenic bone graft—substance from an individual of the same species but generally unrelated. Example—freeze dried cadver bone.
3. Alloplastic graft—calcium hydroxyapatite.
4. Metalmesh with autogenous cancellous bone.
5. Metalmesh with calcium hydroxyapatite.

Mandibular augmentation by superior border grafting by Davis in the year 1970. This technique for ridge augmentation two fifteen-centimeter autogenous ridge grafts is used. One rib is placed on the cortex and the other contouring the shape of the mandible and both the graft fixed with transocious and circummandibular wiring. The surgical flap is then closed. The iliac crest as a graft is also used in this procedure.

The inferior border grafting was first described by Marx and Saunder in the year 1986, for reconstruction of the mandible following resection again modified by Quinn in the year 1991 for augmenting atrophic ridge and subsequent placement of implant.

The visor osteotomy and the modified osteotomy the aim to increase the height of the mandibular ridge for denture supports.

Sinus lift procedure: It is a popular procedure combined with simultaneous or delayed implants. After raising subperiosteal buccal flaps, a window is created to expose antral lining. Lining of the floor and walls is elevated intact and this space is filled with bone from the iliac crest to provide retention for implants.

Prof JR Moore recommended the use of bones substitute is calcium hydroxyapatite in the form of small granules of about 1 mm. diameter, either solid or porous. This material produced in the laboratory is chemically similar to the inorganic phase of bone. The particles are injected into pockets beneath the periosteum.

Ingrowth of fibrous connective tissue and new bone formation stabilizes the mass of particles and produces a firm support for the denture. However, there is a tendency for the particles to migrate from the crest of the ridge into the sulcus, with reduction in the height of the augmented ridge and obliteration of the sulcus. To prevent this a tissue-expander inserted into the subperiosteal pocket for two weeks will result in a fibrous tissue-lined tunnel into which the hydroxyapatite particles are injected. This creates a more stable augmentation of the alveolar ridge.

TWENTY-EIGHT

Tidbits of Implants and the Role of Oral Surgeon

• Implant and the Oral Surgery • Concept of Implants Procedures • Definition • Weiss Theory of Fibro-osseous Integration • Indications • Surgical Modalities

Implant and the oral surgery: Implants are alloplastic materials, i.e. placed into the jaw to provide supportive measure to crown or fixed/removable prosthesis.

The success of implants the factors are responsible as follows:

1. The implant must be bioacceptable and inert.
2. The surgical factors includes the adaptation of implant is important. Placement of implant must be attromatic surgical man over, careful about thermal injury to the bone. Implant should be correctly placed to ensure optimal loading by the prosthesis. This requires the careful cooperation with the prosthodontist.

Concept of implants procedures especially for oral implants including recommended by the various authority of which P I Branemark in the year 1982, is the pioneer authenticated, *established concept explain as Barnemark theory of osseointegration*. This theory proposed that implants integrate with bone such that the bone is laid very close to the implant material without an intervening connective tissue.

Osseointegration can be defined as, "Osseous integration (1993) the apparent direct attachment or connection of osseous tissue to an inert alloplastic material without intervening connective tissue. The process and resultant apparent direct connection of the endogenous material surface and the host bone tissues without intervening connective tissue. The interface between alloplastic material and bone."

Branemark also stated that the implant should not be loaded and must be and left out of function during the healing period for osseous integration to occur.

Osseointegration is a clinically asymptomatic rigid fixation of the implant within bone, during functional loading. This means that there is stable anchorage of the implant with bone covering its entire surface without an intervening connective tissue. So, the interface between the tissue and the implant is a strong one, which can withstand occlusal loads. To understand this phenomenon, the structure of this interface and factors affecting this area should be studied.

Weiss Theory of Fibro-osseous Integration

Weiss theory states that there is fibro-osseous ligament formed between the implant and the bone and this ligament can be considered as the equivalent of the periodontal ligament found in the gomphosis.

He defends the presence of collagen fibers at the bone-implant interface. He interpreted it as the peri-implantal ligament with an osteogenic effect. He advocates the early loading of the implant.

The types of implants available in the large varieties from titanium or hydroxyapatite coated titanium. Bioceramics are also available.

Types of implants according to placement and the materials components:

1. Subperiosteal
2. Transmucosal
3. Osseointegrated

The last one is most commonly use.

Indications

1. Edentulous jaws unable to retain dentures, partial prosthesis for bridge abutments, single anterior tooth replacement.
2. Maxillofacial prosthesis following trauma and cancer surgery.
3. Complete over-denture.

Prior to surgical technique X-rays of periapical, OPG, lateral cephalogram, tomogram and CT scans are required.

Surgical Modalities

1. Joint coordination between oral surgeon and prosthodontist is essential for success.
2. Conventional denture modification should have been tried, a balanced occlusion should be creatable, and a good oral hygiene is mandatory.
3. The surgical procedure is required high-specialized instruments and the surgeon is also trained accordingly.
4. Installation of fixture. A mucoperiosteal flap is raised, based lingually and receiving channel is prepared in bone, using matched spiral drills.

The entrance to the fixture site is countersunk, and depending on the type of implant, either it is pressed into place or if the channel is threaded, a fixture screwed in. In 2-stage procedures, the implant is covered by the flap at the end of the procedure. It is helpful when placing multiple implants that a direction indicator is used to achieve parallelism. Bone overheating must be avoided by constant irrigation. In 2-stage procedures, a healing period of 4 months in the mandible and 6 months in the maxilla is recommended. In 1-stage procedures a connecting bar can be fitted within 2 weeks but load-bearing or retentive studs should for 4 to 6 months.

In 2-stage procedures, abutment connection is then carried out by punch excision of mucosa overlying the implants, removal of cover screws, and insertion of the abutment. A postoperative surgical pack is usually used, prosthetic procedures starting about 2 weeks after abutment connection.

Alveolar augmentation require for placement of implant by sinus lift procedure by filling with bone from iliac crest to provide retention from implant.

Transmandibular implant: A box frame constructed and placed in the mandible from a submental incision. Provide to increase bone reposition.

TWENTY-NINE

Excerpts of Osteodistraction Technique

• Osteodistraction • Aim and Objects

Osteodistraction means the technique by which controlled, calculated, lengthening and widening of bone is achieve according to need of the patient as per desired by the surgeon.

In this technique, an appliance known as distracter, applies gradual force for lengthening and widening of the bone.

Concept

The technique of long bone lengthening by Ilizarov G. A. of Russia and Bastiani, et al of Italy. Snyder in the year 1973 reported mandibular lengthening. J. G. Macarthy and associate of U.S.A. documented extensive work in the human mandible.

Aim and object of this corrective technique is to achieve symmetry of face due to disproportionate of the jawbones.

This may be placed either extraorally or intraorally.

The following investigation and the selection of the cases the 4 steps surgical protocol as follows:

- Gap osteotomy to be made at the area of which distraction will start
- Placement of distracter and gradual distraction after 7 days of osteomosied gap or site
- Regular monitoring the area
- After desired lengthening and widening is achieve, removal of distracter. Orthodontist coordination may require.

After latency period of 7 days, the distraction occurs with a rate and rhythm of 1 mm per day (completed by activating appliance 0.5 mm twice daily). Once this distraction is complete the appliances is left is place for the consolidation phase, which is usually 2 to 3 times the amount of time require for the distraction phase.

The amount of activation per day is termed the rate of distraction, the timing of appliance activation each day is termed the rhythm. During the phase of distraction the new immature bone is called the regenerate once the appropriate amount of distraction has been achieved the appliance remains in place this consolidation phase is allowing the formation of mature bone and term is remodeling period.

The mandibular lengthening as well as the widening of osteogenesis distraction protocol intraorally summarized *by Suzanne U et al* as follows:

Osteotomy

After the intraoral distraction has been adequately-fixed, an osteotomy is completed and the distractor is activated 2 mm. The soft tissues are meticulously closed, paying special attention to the periosteal layer.

Latency Period

The activation of the distractor must be performed 7 days after surgery in order to allow primary healing of the soft tissues to take place, along with collagen fiber type I formation between the bony walls, as a net to be stretched.

Rate of Distraction

Distraction is performed at a rate of 1 mm daily. Increasing the rate of distraction could lead to fibrous tissue formation, and decreasing the rate could lead to a premature consolidation of the bony fragments.

Rhythm of Distraction

Distraction osteogenesis is performed at a rhythm of once a day. This activation should be performed by the practitioner or by a well-trained patient or parent. In this way, it is possible to avoid uncontrolled activation of the device.

Stabilization Period

Any orthodontic movement is postpond until 8 to 12 weeks after surgery. Following appliance removal, the orthodontist can resume orthodontic mechanics.

During this period, bone apposition in the osseous gap must occur, ensuring normal dental translation into newly formed interdental bone.

The following variables may modify the distraction osteogenesis protocol:

Patient Age

Some authors showed that less time is necessary for an optimal hard and soft tissue response in younger patients.

Quantity of Bone and Soft Tissues

When deficient hard or soft tissue is present, the latency period is prolonged in order to promote the initial healing phase.

Quality of Bone

Deficient quality of bone influences the latency period as well as the rhythm and stabilization period.

Magnitude of Distraction and Amount of Bone Gained

These factors have a direct effect on the stabilization period, which is extended when expansion is larger.

Rigidity of Fixation

Following distraction, some intersegment micromotion must be present in order to achieve ideal bone formation. Some investigators observed that too much rigidity of the plate would cause a mechanical stress bypass, which apparently prevents the final stages of normal bone reconstitution. The use of a more flexible plate eliminates the occurrence of stress fractures, demonstrating that some movement enhances bone formation. On the other hand, too much movement guides the healing process into cartilage and fibrous tissue formation, which prevents bone formation.

Bone Transport Protocol

The bone transport protocol is similar to that used during widening or lengthening of the jaws. A 7-day latency period must elapse before activation of the device. Distraction is done at a rate and rhythm of 1 mm daily, until the bone fragments contact. After contact, some fibrous tissue can be found between the bone fragments, which must be removed with a curet. A 703 bur is used to produce bone bleeding, and activation of the distractor is performed to obtain compression osteosynthesis. Maximum bone extension is obtained 48 hours after the completion of the distraction, and this is why curettage and device removal are delayed until 3 or 4 days after the last appliance activation. During this time, some elongation is still occurring in the soft tissues, as well as stabilization of the newly formed bone. On the other hand, if distractor removal and clearing of the intersegment fibrous tissue are delayed for a longer time, a premature bony consolidation can occur, preventing the transport fragment from closing the remaining gap.

FURTHER READING

1. Guerrero CA, et al. Intraoral distraction in the year 1999.
2. JJ Macarthy, et al. Lengthening of human mandible by gradual distraction.
3. Myron RT. Correction of dentofacial deformities by distraction osteogenisis.
4. Samchukov–Distraction osteogenisis.
5. Suzanne U, et al. Distraction osteogenesis: A Unique treatment for congenital micrognathias.

THIRTY

Tissue Transplantation, Flap and Current Concept of Bone Grafting

• Tissue Transplantation • Homogeneous Tooth Transplantation • Autogeneous Tooth Transplantation • Perspective of Biological Factors of Bone Graft • Classification • Important Flaps

TISSUE TRANSPLANTATION

Changing position of the tissue from one place to other. This may be soft or hard bone tissue. Bone is the most commonly utilized in oral surgical procedures, although skin grafting has become popular in some areas of pre-prosthetic surgery and post-cancer rehabilitation. Cartilage and fascia are rarely used as tissue graft in oral surgical procedures.

Phillip J. Boyne summarized the transplanted substances as follows:

1. Autogenous graft composed of tissues taken from the same individual;
2. Homogenous grafts, which are divided into two types:
   a. *Allografts* (or allogeneic grafts) composed of tissues taken from an individual of the same species who is not genetically-related to the recipient.
   b. *Isografts* (isogenous or syngenesioplastic grafts) composed of tissues taken from an individual of the same species who is genetically-related to the recipient.
3. Xenogeneic (heterogenous) grafts, which are composed of tissues taken from a donor of another species (for example, animal bone grafted to man).

Homogeneous Tooth Transplantation

In this procedure pulpless, fully-matured teeth from a homogeneous allogenic source initially achieved the acceptance. However, ankylosis and progressive root resorption is the almost universal feature of such surgical procedures.

Autogeneous Tooth Transplantation

Hale et al and Apfel H. and others describe a detail surgical procedure for the transplantation of developing third molar to the first molar position in the younger age groups as the first molar is very prone to caries. The extraction of third molar removed atraumatically from the donor site and placement of the tooth after removal of first molar. Then the tooth is stabilizing by S S Wire ligatures over the occlusal surface of the transplanted crown. Some surgeon prefers acrylic for stabilization.

Reimplantation is dental procedures indicated the avulsed or exfoliated tooth reimplanted, or reinserted to the original alveolar socket following root canal treatment.

A graft is transfer tissue which dependent on the donor site capillaries for his survival.

A flap is transferred tissue, which is, at least initially, independent of the donor site capillary for survivor.

Skin graft may be split thickness or full thickness. Split thickness graft (taken by Dermatone from thigh and inner arm) and quickly transfers in the mouth and placed with the sutures. Full thickness skin graft provided a good color-match when repairing the skin defects of the face.

Pre-bone grafts from the ribs iliac crest or clavarium. Costochondral rid graft, which partially split at 1 cm interval, can be bent to contour in the shape of the mandible.

Robert A. Bays cited from William Irby, the ideal graft system should be:

1. Exist in unlimited supply without the need for violation of a distant donor site;
2. Provide immediate osteogenesis for rapid consolidation;
3. Elicit no adverse host response, such as immune reactions;
4. Facilitate revascularization, which assists early healing and resistance to infection;
5. Stimulate osteoinduction of recipient site cells;
6. Be adaptable to a variety of physical requirements;
7. Present no impediment to growth or orthodontic tooth movement;
8. Provide support and stability where discontinuity or mobility exists;
9. Provide a framework for osteoconduction; and
10. Be completely replaced by host bone of the same or superior quantity and quality as quickly as possible.

Bone is very popular for correcting contour defects. Grafts may be used in the various forms which is:

1. Block from tibia, rib or ilium.
2. Osteoperiosteal graft from tibia.
3. Chip grafts from ilium.
4. Pedicle graft from mandible.

The iliac crest block graft has various advantages. This largely cancellous, and allows rapid transmission of tissue fluids and nutritive elements and provides innumerable pathose for ingrowth of growing cell. It can be readily shaped to contour and mortise.

Chip grafts may be obtain with a gouge after creating a window in the outer cortex, thus leaving the outer cortex undisturbed.

Boyne Phillip J specially advocated used of particulate grafts of marrow of cancellous bone, containing a metal implant nesh device line with a microporous filter material for graft reconstruction of large defects of mandible.

Perspective of Biological Factors of Bone Graft

The viability of cells present in fresh autograft, viable cells are present only if marrow and endosteal elements are included and properly preserved. This requirement is met by harvesting autologous cancellous bone and marrow as close to the time of placement as possible, certainly within 2 hours. Some investigators have recommended preservation of the graft in saline or D5W, whereas others warn against the use of any artifactual solution, including saline, lest the osteoprogenitor cells be inactivated. Covering the autograft with a saline-soaked sponge to prevent drying without immersion of the graft may be the best method for autograft preservation. The viable cells transplanted in an autograft include hemopoietic cells, reticular cells (contiguous with the endosteum), and undifferentiated perivaseular cells (connective tissue cells).

The insult of transplantation stimulates degeneration of the hemopoietic elements, which probably make no contribution to osteogenesis. Gray and Elves showed that endosteum-free marrow has little or no osteogenic potential. Following transplantation, the reticular cells (osteoprogenitors) are stimulated to begin osteogenesis. If these cells are transplanted alone without bone matrix, the bone that is rapidly formed is also rapidly resorbed, leaving very little residual bone. Also, these cells do not seem to stimulate much osteoinduction from the host. Therefore, transplantation of marrow and endosteal elements without organic matrix apparently does not ensure lasting bone formation. Revascularization of such a graft is rapid so that resistance to infection and ease of healing are facilitated.

The undifferentiated perivascular connective tissue cells that are transplanted with an autograft are mesenchymal-type cells like those in the recipient site, with the potential to differentiate into osteogenic cells if stimulated. This stimulation apparently comes from organic bone matrix.

In summary, under the best conditions most of the viable cells in an autograft are hemopoietic, reticular, or undifferentiated perivascular cells. The first degenerate, the second form bone in a few days if they survive, and the third must be stimulated to differentiate into bone forming cells over several weeks.

A simple lucid classification of various grafts and alloplastic material is as follows:

Autogenous grafts Use the patient's own tissue:

- Skin grafts—split skin graft, full thickness skin graft
- Bone grafts—cancellous, corticocancellous
- Grafts grown in tissue culture 'to order', e.g. skin for patients with extensive burns.

Allografts Tissue from a human donor specially prepared to reduce abnormal antigens:

- Bone grafts
- Cartilage grafts.

Heterografts Tissue from another species, again treated to reduce any recipient immune reaction. Specially bred animals, with genetically-manipulated compatibility genes to overcome rejection problems, may make these grafts more popular.

Alloplastic materials These should be biocompatible. Materials used in oral surgery include internal fixation plates and screws—Titanium, stainless steel, cobalt-chrome.

Resorbable materials Sutures, internal fixation screws and plates: polyglycolic acid (Dexon), polyglycolic/polylactic acid (Vicryl), polydioxanone (PDS).

Orbital wall/floor reconstruction material Sialastic sheet, vicryl sheet.

Bone substitute Ceramics, hydroxyapatite.

Contour materials Gore-tex, proplast.

Soft tissue crease/wrinkle obliterative materials collagen.

The flaps are used to repair reconstructed the defects of the soft tissues of the jaws. *Paletta F. X.* advocated the use of advancement or rotation flap is probably the best choice of method for reconstruction. The flaps may be classified:

1. *Local flap* utilized the contiguous tissue and requirement as (a) advancement, (b) rotation and (c) transposition
2. *Distant flaps* are those carried over and area of normal skin of a pedicle that is later sectioned and return to the donor site. The distant flap again divided into two flaps—one is direct and other is indirect. The indirect flap may be migrated in steps from a distant area to the face and carried on the arm.

Regarding the local flap it is very much popularize by a group of French surgeons is sometimes called as *French flap (Pick J. F).*

The simplest form is probably exemplified by undermining the ages of a wound to facilitate closure.

The direct advancement flap is created by under mining the tissue of one margin of wound defect and creating parallel incisions at the borders of the under mined area for the purpose of closing the defect.

Although the *lip shave (Vermilionectomy. Vol. I)* in the past has been consider a modification of the advancement flap. In recent year surgeon has performed this procedure without a true advancement.

Incising the donor tissue in semicircular fashion to allow rotation into a defect creates rotation flap. The both advancement and the rotation flap both be facilitated by either the cut back or a triangular excision of tissue.

A transposition flap is one that is rotated at an angel, jumping and area of normal tissue to reach the defect.

Another variety of local flap is inturned in which the margins of a defect are incised, under minded and turn into from the back side of the defect, if a double lining is required such as nasopalatine fistula or antrofacial fistula.

Pedicle flaps, in general, have the advantage of possessing subcutaneous tissue as well as skin, thereby providing depth and pliability to the repair. Local flaps have the additional advantages of desirable colour and texture we well as simplicity and diminished time requirements. These flaps have wide application, and several variations have been use in closure of oroantral fistulas for many years. The use of a combination of local flaps in repairing an oronasal fistula caused by trauma.

Modification of local flaps is the Z-plasty and V-Y flap. The Z-plasty is a double rotation flap may be used as a transposition flaps. It is most effective method for releasing tension on a linear contracture. Rotation of the flaps allows the direction of tension to be changed with consequent relaxation of the tension of the original axis (Figs 30.1 and 30.2).

Uses This is applicable at the corner of the mouth or the ala of the nose is depressed or elevated.

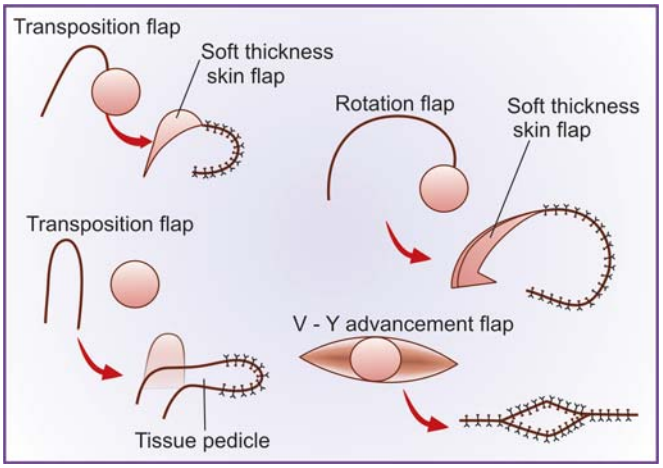

Fig. 30.1

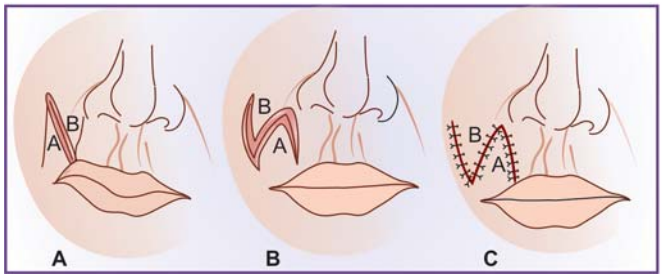

Fig. 30.2: (A) Scar contraction produces lip distortion, (B) Flap switch naturally and lip distortion relieved, (C) Orientation of central member turned 90° (Cited from Luis C Cuadros and G Gallico III)

The V-Y procedure for lengthening the localized area and Y-V procedure for shortening localized area of tissue.

Other important flaps, which include:

1. *The Abbe or Estlander flap.*
2. Straight advancement with triangular excision of skin.
3. *Transposition flap,* such as the nasal labial flap.
4. Nasolabial flap: Random pattern pedicle flap-based above and lateral to the upper lip; useful small local flap. Requires division later.
5. *Tongue flaps:* Random pattern pedicle flap for lip and palate repair. Requires division later.
6. *Forehead flap:* Based on anterior branch of superficial temporal artery and is a very safe flap. Entire length of forehead can be raised, quickly, but leaves bad donor site. Requires division later.
7. *Masseter muscle flap:* Limited in size, can be used intraorally.
8. *Temporalis flap:* Inferiorly based on deep temporal branches of maxillary artery. For intraoral reconstruction, limited use.
9. *Other mucoperiosteal flaps:* Buccal advancement flap and palatal rotatory flap for repair of oroantral fistula.

   Envelope flap: In case of impacted third molar surgery.

THIRTY-ONE

Tidbits of Commonly Used Therapeutics in Oral Surgery

• Therapeutics—Application • Recent Trends of Antibiotics

Local application by the surgeon is as follows:

- Thirty to forty percent of trichloracetic acid. It is used as chemocaute4rization agent. In case of infected operculam in pericoronitis.
- Whitehead varnish (composition iodoform 10 G, benzoin 10 G, prepared storax 7.5 G balsum of tolu 5 G, solvent ether add 100 ml) used as pack in case of post-surgery.
- ZOE pack used in dry socket as an obtundant agent.
- Cornoy's solution also used as chemocauterizing agent at the end of enucleation of primordial cyst.
- Surgicel–oxidized cellulose used as local hemostatic.
- Gelfoam same as previous use.
- Hemolock (feracrylum HCl) used as previously mentioned.
- Horsely's bone wax (bees wax 7 parts olive oil 2 parts, phenol 1 part) used control bleeding from the bony bed.
- EACA (Epsilon aminocaproic acid) this may be used locally and systematically.
- Ethampsylate (it can be used locally as well as systematically).

Local used by the patient: Various mouthwash to prevent infection of the mouth following oral surgical procedure:

- Chlorhexidine, povidone iodine mouthwash/ gurgle.
- Benzydamine, tantum oral rinac, 0.15 percent W/V in case of painful mouth condition prior to consume meal.
- Topical antifungal agents, nystatin or mycostatin oral suspension 1 lakh units per ml used as oral rinse 4 times daily for 2 minutes, 2 to 5 ml, then swallow. Used in candidiasis.
- Candid mouth paint clotrimazole 1 percent W/V solution used as antifungal agent.
- Kamillosan mouth spray standardized chamomilla extract (German remedies) used as oral wound healer. It is also available as liquid.
- Dentogel, gelora used as application in the tender mouth for relief pain. Composition of dentogel and the gelora are same, i.e. choline salicylate 8.7 percent W/V.
- Saliva substitute bio-extra gel 25 mg it containing lactoferrin, lysozyme, lactoperoxidase, immunoglobulins and colostrums extract (Lykahetero). It is used as oral moisturizing gel in case of xerostomia.
- Saliva stimulant includes pilocarpine hydrochloride solution 1 mg per ml used as one TSF (about 5 ml 3 times daily) to increase the salivary flow in case of xerostomia.

Recent trends of antibiotics: The endocarditis prophylaxis, and in the case of diabetic patient who is prone to infection. The minor oral surgical procedure require the antibiotic regimen which as follows:

- Amoxicillin 500 mg (novamox, wymox) 6 capsules 1 hour before procedure, and 3 capsules after 6 hours. In case of allergic to above drugs erythromycin 250 mg 4 tablets 2 hours before procedure, 2 tablets after 6 hours. If the patient is allergic to both of above-mentioned drugs clindamycin 150 mg 2 capsules 1 hour before procedure, 1 capsule after 6 hours.
- In case of severe risk adult patient, ampicillin 2 gm. and Gentamicin 1.5 mg per kg body weight not to exceed 80 mg IV or IM route 1 hour before procedure.
- Moderate infection ciprofloxacin 500 mg with tinidazole 300 mg, this combination (ciplox–T Z

or cifran–T) commonly and routinely used in normal orofacial infection for 5 to 7 days.

- Moderate to severe infection, author's clinical experience cefotexime (omnatax, taxim) 1 to 2 gm twice daily IM, IV as ceftrioxone (monocef 1 to 2 gm IM or IV twice daily is effective. In addition to that, metronidazole 400 mg 3 times daily in oral route also effective in anaerobic infection in orofacial origin.
- In case of bone infection author prefers the use of lincomycin 600 mg IM daily or divided dose for 5 to 7 days. The use of drugs should not be more than 10 days.
- Pain relieving drugs: In case of mild pain aspirin 325 mg, ibuprofen 300 mg, acetaminophen 325 mg may be used.
- In case of moderate pain double, the dose of above mentioned drugs. In addition to ketorolac 10 mg every 6 hourly.
- In case of severe pain fortwin (pentazocine an opioid analgesic 25 to 100 mg every 3 to 4 hours after food in case of severe pain. IM and IV or SC 30 to 40 mg 6 to 8 hourly as per requirement.
- Injection voveran also a good drug in case of pain following surgery. Diclofenac sodium 75 mg of 3 ml injected deep IM. Voveran also used as tablet for oral use 50 mg tablet 3 times daily after food.
- In case of severe intractable pain injection morphine sulfate 10 mg per ml IM to be given. Injection pethidine 25 to 100 mg IM or IV according to the case.
- In oral surgery, anxiolytics used for phobic patient as short time therapy 1 to 2 weeks. Valium 5 mg, i.e. dizepam 1 tablet at bedtime.
- Injection dizepam also used for sedation anesthesia. IV 10 mg slowly pushed.
- Muscle relaxants chlorzxazone with acetaminophen 500 mg 2 tablets every 4 hourly.
- Anti-inflammatory medicine to prevent swelling. Chymoral forte and chymotripcin are used in routine practice. Chymoral forte 1 tablets every 6 hourly half an hour before meal for 4 to 5 days.
- Sometimes corticosteroid—injection betnesol IM given to reduce severe swelling tailing and tapered the doses.
- Injection triamcinolone intralesional given in case of oral submucous fibrosis and intra-articular injection in case of T.M. joint pain.
- In case of anaphylactic shock, injection adrenaline 1:1000 (1 mg/ml) in 1 ml ampules, intramuscular or SC 0.3 to 0.5 ml slowly given.
- In case of antiallergic reaction, injection avil or oral tablets may be prescribed.
- Sodium tetradecyl sulfate (Sclerozing agent) I/L given to the capillary hemangioma.

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